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Major purposes of the conference were to help educators develop a concept of the developmental process and to provide mutual learning among the 10 participants. Answers to two questions were sought: "What is an educational development project?" and "How should one go about planning or conducting educational development projects?" These papers were presented. "The Economic Evaluation of Development Projects in Education" by Ernst W. Stromsdorfer discusses basic principles of design which allow economic evaluation of development projects. "Some Decision Points and Alternatives in Developmental Curricula" by Hulda Grobman suggests 18 considerations on this topic. "A Perspective of Developmental Projects" by John D. McNeil reviews guidelines for the organization and operation of developmental projects. "The Relationship of R&D to Educational Improvement: An Output-Oriented Model" by Hendrik D. Gideonse contrasts research and development projects to educational development projects and presents a graphic model of the differences. A model of the developmental project process is included. (EM)

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REPORT
OF A
DEVELOPMENTAL PROJECT GUIDELINES CONFERENCE

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Minnesota Research Coordinating Unit in Occupational Educatio
University of Minnesota, Minneapolis, Minnesota

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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THE REPORT OF A DEVELOPMENTAL PROJECT GUIDELINES CONFERENCE. (Minneapolis, June 13-15, 1968).

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Jerome Moss, Jr., Ed. and others.
David J. Pucel
Frank C. Pratzner
(Editors)

An Invitational Conference Sponsored and Conducted by the

3 Minnesota Research Coordination Unit in Occupational Education,
~~University of Minnesota~~
Minneapolis, ~~Minnesota~~ 55455

with partial support by a grant from the

3* Upper Midwest Regional Educational Lab~~oratory~~
St. Paul, Minn~~esota~~. 55114)

June 13 - 15, 1968

Thunderbird Motel
Minneapolis, Minnesota

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Introduction

Background and Objectives

"Developmental" projects have become an important and distinct segment of research-related activities in education. It appears logical to assume that the present move to give states greater autonomy in the use of research-related funds will result in a further increase in developmental activities. On the other hand, very little guidance is available to potential "developers" to assist them in understanding the "developmental process" or in planning "developmental" projects. Textbooks on research methodology and programs for training researchers typically ignore the potential differences between the research and the developmental processes. While paradigms are available for research, they have not been formulated for development.

Since an important responsibility of Research Coordination Units is to provide technical consultation to persons involved in research-related programs it seems mandatory that Unit personnel (a) attempt to understand the developmental process, and (b) begin to formulate and organize guidelines that will assist their clientele in planning and conducting developmental projects.

The "Developmental Project Guidelines Conference" grew out of this concern. Since so few published materials were available, and because Unit personnel had limited first hand experience with developmental projects, it was decided to organize an exploratory conference -- one in which a small group of carefully selected participants would be encouraged to pool their relevant experiences and ideas in a relatively unstructured situation. It was felt that a more fruitful, creative approach to the investigation of the general problem area could be obtained by using available expertise in this manner, rather than by utilizing the more typical but restrictive technique of requesting reactions to materials pre-developed by the conference directors. The major purposes of the conference were seen as (a) helping Unit personnel (and through publication other concerned educators) develop their concept of the developmental process, and (b) providing an opportunity for participant-experts to learn from each other.

Conference Organization

Six participants were invited; they, plus a conference leader and the three conference co-directors constituted the total number of conferees. Three of the participants were asked to prepare papers for circulation in advance of the conference. The other participants were invited to submit written reactions if they desired. During the two and one-half day meeting, each author of a paper was given limited time to discuss his or her prepared material; the remainder of the time was devoted to free-flowing discussion.

Since it was necessary to provide some kind of guidance to participants in advance of the conference, two major questions (with some subquestions) of concern to Unit personnel were formulated and distributed to the participants. While discussion, and the prepared papers, were not limited to these questions, they proved fairly central to the concerns and perceptions of the participants, and were therefore of some organizational value.

The leader selected for the conference was a staff member of the Upper Midwest Regional Educational Laboratory. Not only did the Laboratory provide the bulk of the financial support for the conference as a service to the Coordination Unit, but it also is vitally concerned with the problem area; the Laboratory supports and conducts developmental projects. Immediate, first-hand feedback to the Laboratory was thereby assured.

The conference was held June 13 - 15, 1968 at the Thunderbird Motel, Minneapolis, Minnesota.

The Report

Obviously, this report is not a complete transcript of the two and one-half day discussion. It presents the written materials prepared specifically for the conference, a very relevant paper by one of the participants originally prepared for publication in a journal, a summary of the discussion, and some tentative conclusions reached by the conference co-directors. The conference co-directors were responsible for summarizing the discussion in the form contained in this report. The participants had two opportunities to review the discussion summary; first, while at the conference, and again in its present written form. It is therefore hoped that the material reflects the essence, if not the exact words, of the discussion. Not all the material reported was agreed upon by all the participants, although most of it had the support of the majority.

No attempt was made to credit individuals with specific statements. Each participant played an important role throughout the meeting. To each, we, the co-directors, express our sincere appreciation for their cooperation and substantive contribution represented by the content of this report.

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Conference Guidelines

Two questions of major concern were posed to give direction to, and serve as guidelines for the preparation of papers prior to the conference and to direct and guide discussion and reactions to the papers at the meetings.

1. What is an educational development project?...was posed in order to direct attention to the definition and description of developmental projects in terms of the:

    a. possible relationship (similarities and peculiarities) among developmental projects, research projects, school operations projects and dissemination projects regarding the initiation, problems, outcomes, and activities of each.

    b. implications of the above differences and similarities for i) planning and ii) operation of developmental projects.

2. How should one go about planning (or conducting) educational development projects?....was posed in order to investigate possible guidelines for or description of:

    a. the steps and/or sequence of action in planning a developmental project.

    b. the interrelationships among those steps. (Are the steps the same for each kind of development project?)

    c. the implications of the above procedural characteristics for staff, processes and organization.

Conference Agenda

June 13th

9:00 - 9:30 a.m. - Opening Remarks
Dr. Maxwell, Conference Leader
9:30 - 10:30 a.m. - Presentation of Paper
by Dr. Stromsdorfer
10:30 - 11:00 a.m. - Coffee
11:00 - 12:00 a.m. - Presentation of Paper
by Dr. Grobman
12:00 - 1:30 p.m. - Lunch
1:30 - 2:30 p.m. - Presentation of Paper
by Dr. McNeil
2:30 - 3:00 p.m. - Coffee
3:00 - 5:00 p.m. - Discussion
5:00 - 7:00 p.m. - Dinner (arranged)
7:00 - 9:00 p.m. - Discussion

June 14th

9:00 - 9:30 a.m. - Summary of First Session
Dr. Moss
9:30 - 10:30 a.m. - Presentation of Paper
by Dr. Gideonse
10:30 - 12:00 a.m. - Discussion
12:00 - 1:30 p.m. - Lunch
1:30 - 3:00 p.m. - Discussion
3:00 - 3:45 p.m. - Coffee
3:45 - 5:00 p.m. - Discussion

June 15th

9:00 - 9:30 a.m. - Summary of Preceding Sessions
Dr. Moss
9:30 - 12:00 a.m. - Conclusions & Recommendations
12:00 - ---------- - Adjournment

Papers, Reactions, Discussion Summary

The Economic Evaluation of Development Projects in Education

A paper prepared for

THE DEVELOPMENTAL PROJECT
GUIDELINES CONFERENCE

JUNE 13-15, 1968

A conference sponsored by the

Minnesota Research Coordination Unit in
Occupational Education,
University of Minnesota
Minneapolis, Minnesota 55455

by Ernst W. Stromsdorfer
Department of Economics and
Institute for Research on
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The Pennsylvania State University

The author is indebted to the generous criticisms of his colleagues, Teh-Wei Hu, Maw Lin Lee and David W. Stevens. Their comments improved this paper considerably. Of course, any errors are the author's responsibility.

Introduction

Much research designed to evaluate new techniques in education is limited in scope and does not permit comparative judgments to be made between alternative methods of achieving the same objective. It is often research which shows what the absolute impact of a technique, say, the introduction of a teaching machine, is. And, of course, one can discover the general cost dimensions of this new technique in terms of time and resource outlay. However, the design and execution of the research is such that no comparative analysis can be made of the technique in question and all other alternative courses of action. Thus, while this type of research is of value, it is only of partial assistance in making efficient choices and, to the extent that such research is used in making choices, it does so only imperfectly and at the risk of making errors; errors in the sense that a different technique might have achieved the same result at a smaller expenditure of time and resources.

Economic analysis of all types of investment in the human agent has come into vogue in recent years. Some of it has been very good, but much of it is badly and inexpertly done. For instance, analysis is often conducted (and even paid for at nontrivial prices) where one of the most elemental aspects of research design, an appropriate experimental and control group, is lacking.

Economic Analysis of Educational Alternatives

This paper specifies some of the basic principles of proper research design in the economic evaluation of developmental and other types of educational projects. This economic evaluation is known under different titles--cost-benefit analysis, cost-effectiveness analysis, systems analysis and so forth--but it is simply economic analysis.

What does economic analysis have to offer in the area of educational decision making? It offers a frame of reference designed to systematically investigate the competing claims of alternative means of achieving the same objective. Where alternatives do not exist, economic analysis is not relevant.

This type of economic analysis has three major characteristics. First, it is quantitative. As will be shown below, costs and benefits can be expressed in either monetary or non-monetary terms. But for the models we present above no non-monetary costs will be considered. Second, this analysis must be directly related to the objectives being served by any given set of alternative programs. Thus, the proper definition of the objective or objectives being served is critical to the analysis. Ill-conceived specification of objectives as well as ill-conceived choice and construction of indices to measure the attainment of these objectives will result in a failure of the analysis to provide information in making choices among competing alternatives. Finally, this analysis links costs with benefits.

Treatment of either costs or benefits in isolation of the other cannot provide valid information in making choices. Costs and benefits of the entire program, however its limits are defined, must be considered in conjunction for any evaluation of alternative programs or actions. The net effectiveness of any program is due to the joint effect of costs and benefits as these have their impacts over time.

These steps, then, must be followed in order to undertake an evaluation and comparison of alternative programs:

1. Objectives of the program must be specified;

2. Processes or activities to implement the program objectives must be developed;

3. An index or indices of performance of the activities which are intended to measure program effectiveness must be specified;

4. A production function must be specified by which the output of any given activity can be related to a set of related inputs;

5. A cost function based on the production function given for each activity must be specified; and,

6. A comparison between benefits (performance indices) and costs must be performed.

These points will be considered in turn.

Program Objectives. Specification of program objectives is critical to any comparative analysis of programs. Education itself has multiple objectives. For instance, the objectives of education can be ones of

a. Efficiency or increasing economic output;

b. Equity or income redistribution;

c. Pure consumption or enjoyment of education for its own sake; and,

d. Socialization or development of socially effective behavior.

The achievement of each of these objectives satisfies specific desires or wants of society or individuals. The particular manner in which the achievement of these objectives is related to the creation of satisfaction or increased well being is described in what is known as a welfare or utility function.

Each of the above objectives enters into a welfare or utility function for any society which engages in the production of education. Each of these objectives enters into the utility function of any individual who provides or partakes of education.

However, the four objectives listed above are much too broad to be directly amenable to analysis and must be broken down, if possible, into empirically manageable components. For instance, the equity objective for education or any given developmental program in education should be specified as to the nature and amount of the income redistribution which is desired as well as the groups which are to be potentially benefited or, perhaps, penalized.

Thus, welfare or utility must be defined in terms of its components, which themselves must be made much more specific so that they can be measured in some way. Thus, if economic efficiency is one of the elements contributing to social or private welfare, economic efficiency must be expressed in terms of some measurable quantity. Then, to maximize that quantity of welfare gained which is attributable to efficiency, one should maximize efficiency. For a given developmental program in education, efficiency is maximized by minimizing cost (monetary and non-monetary) subject to some specified level of gain or by maximizing some particular benefit subject to some specified level of cost.

If the efficiency objective of a developmental program is to increase earnings of the participants, then the maximization of the net addition to earnings attributable to education relative to the costs of achieving that education is a first step in achieving economic efficiency. Yet, again, once this is done, only one aspect of utility or welfare has been maximized and the single-minded pursuit of this objective may result in a reduction in marginal benefits to be achieved from other objectives on which total welfare depends. The interrelationship of these objectives must be borne in mind.

Thus, economic analysis of education must always be partial in scope and, indeed, the economic analysis of any given educational activity or program must be partial in scope. This limitation of economic analysis must always be borne in mind. For instance, one must not lose sight of the fact that maximizing the new present value of an income stream attached to a person or set of persons participating in a vocational-technical curriculum is the same thing as maximizing the overall utility to the person or society resulting from the vocational-technical curriculum. And, also, it must be stressed that maximizing the new utility flowing from the vocational-technical curriculum does not necessarily imply an equal net addition to the total utility of education as a whole. There may be ways in which the pursuit of objectives at a lower(higher) level in a program actively conflict with or contradict the pursuit of objectives at a higher(lower) level in the overall context of an educational program.

Activities to Implement Objectives. Herein lies the development of alternative activities to pursue the objectives of the program. These activities can encompass two or more different ways of pursuing the same activity in order to achieve a given program objective. Or, they can involve two or more different activities to achieve the given program objective. In the first case, if the program objective is, for instance, to maximize the present value of net earnings, one may develop different curricula in order to see which curriculum, for a given cost, yields maximum net earnings. Comparisons could be made between college preparatory, general and vocational-technical curricula, for instance, to attempt to discover which among a set of instructional techniques imparted the maximum net addition to one's knowledge of mathematics most efficiently imparted--by the teacher in person, by teaching machines, or by television instruction? Or, what is the optimum size of class, other things equal, for maximizing performance on some standard performance test or set of tests.

Specification of the Performance Index. Given the activities chosen are appropriate to pursuing the objectives of the program, one of the most critical states in the analysis is to develop an index or set of indices to measure performance. Any such index can only be an approximate measure of the output of the activity. What, for instance, is the output of a senior high school? Is it the number of graduates? Is it the creation of educated persons? What are educated persons? What is education? Education is a process and an output. What is the nature of education as an output. Is it a stock of knowledge? Is it the ability to reason? Is it the ability to recognize and appreciate the "Good"?

Clearly, the definition of the output is crucial, for a program or activity must be organized and defined in terms of its output.

To continue, what is an index for measuring this output? If the output of education is the acquisition of a store of knowledge and the ability to reason, then performance on a standard test to measure these two components of educational output may be an appropriate index. But, again, it will be an approximate measure since it will never be conceptually nor practically flawless. For instance, no test can measure all aspects of reasoning ability or knowledge. No test can distinguish between that ability to reason which is innate and that which is developed through the learning process. Finally, no test can measure ability to reason independent of one's stock of knowledge because a basic store of knowledge is needed as a frame of reference for all reasoning. Thus it goes. It is not necessary to multiply further examples to demonstrate the complexity of this problem.

The Production Function. The production function specifies the physical output, or outputs, the physical inputs, and the relationship between input and outputs, and, in some cases, interrelationships between subsets of inputs. This function should show the various combinations of inputs which can be used to produce a given level of output. It should also show how output increases or decreases as the proportion of inputs changes.

The general form of a production function is as follows:

(1) $X = f(a,b,c,d)$ where X is output and a,b,c,d are inputs.

If the number of students graduating defines the output of a senior high school, then the inputs could be the number of teachers of a given quality and type, number of classrooms, kilowatt hours of electricity, number of administrative staff, amounts of different supplies and so forth. Finally, this flow of inputs which creates a flow of outputs must be related to time.

Cost Function. It should be possible to measure each of these inputs of the production function in terms of its money cost. The production function of a secondary school or of any educational activity and the prices of inputs determine the cost function. For this cost function it is possible to estimate a total cost of any given activity and also a marginal cost, that is, the extra cost of producing an extra unit of output. Thus, if output is defined as an index of performance on a standard test, and if the unit of observation is that student who has achieved a standard level of performance on the given test, then the total costs of achieving that level of performance can be estimated for a given number of students. And, given that costs are related to the student, the marginal (extra) cost of training an additional (extra) student at that level of proficiency can be estimated.

Other relationships which are not cost relationships can also be estimated. For instance, test performance or the probability of graduation can be expressed as a function of expenditure per student as well as student characteristics, such as teacher quality, size of school, school location and other variables. In such an estimated relationship (again, this is not a cost function) one can calculate the net contribution of these educational inputs (as these are measured in dollars) to test performance or the probability of graduation. Of course, the contribution of each of these inputs is net only in terms of the other elements expressed in the estimated relationship.

Relation of Costs to Benefits. If benefits are non-monetary in nature, then a target level of program performance can be set and that activity which achieves the performance target at the lowest cost (both monetary and non-monetary) is the desirable program. Or, a given cost can be set, and that program which achieves the highest performance level is the desirable program. If both benefits and costs are in monetary terms then internal rates of return to the activities used to implement program objectives can be easily calculated. That activity with the highest internal rate of return is the desirable activity. However, to avoid the possible error that the absolute size of gain and cost will be ignored, net present values of benefits should also be estimated. That activity with the highest net present value is the desirable activity for achieving program objectives. There are serious theoretical difficulties in the practical estimation and application of the internal rate of return and net present value decision rules but these are beyond the scope of this paper.

Generality of the Framework. This simple framework for evaluating an educational activity or project is completely general. Given that objectives are clearly specified, alternative projects to achieve these objectives can be established. Input combinations between alternative projects will likely vary. Input combinations within a given project can be varied. The effects of these two types of variation can be noted on both output and on input costs. The combination of inputs for a given cost, which will then maximize a given output, can then be discovered.

A Simple Model: The Neighborhood Youth Corps. The foregoing can best be expressed in terms of setting up a simple model to evaluate the effectiveness of a particular social investment project in the area of education. The Neighborhood Youth Corps (NYC) was established in part as a dropout prevention program. Its intent is to either return dropouts to school (the Out-of-school program) or to prevent students from dropping out (the In-school-and Summer programs).

One stated goal of the NYC is, then, to encourage students to continue school who otherwise would have dropped out. Consider the Summer NYC program. An index of its output would be the following: For a given cohort of students who complete a school year and who also complete the Summer NYC program, what is the probability:

a. That they will enter the fall term of the next school year; or

b. That, having entered, they will complete the fall term of the next school year; or

c. That, having entered, they will complete the entire subsequent year?

Any of these three measures could be an index of output for the Summer NYC program, depending upon the rigor which one would want to impose as a measure of the "success" of the Summer NYC program.

In order to measure the net effect of the Summer NYC program we want to know how many students who would have dropped out subsequently continue their education only because of their participation in the program. Techniques to measure this directly do not exist. We do not know who the potential dropouts are before the fact. And many students will participate in the program who will never dropout in any case. We cannot appeal to simple comparisons in gross dropout rates before the program and gross dropout rates after the program. Any number of intervening influences could have occurred over the summer to affect dropout rates.

Since "before-after" comparisons are usually irrelevant or erroneous, a control group from the same cohort of students as those who enroll in the Summer NYC program will need to be chosen. Then in a properly specified empirical model, the net effect of the Summer NYC program can be tested. The simplest model would relate the probability of continued enrollment or continued education to the state of having participated in the Summer NYC program. Thus,

(2) $Y = f(X)$

where Y equals the status of enrollment or continued education and X is the status of the student with respect to the Summer NYC program. More specifically,

(3) $Y = a + b_1X_1$.

where Y takes on two values as follows:

1 if the person continues his education; and,
0 if he does not.

X_1 takes on two values:

1 if the person was a Summer NYC participant; and,
0 if he was not; and,
a and b_1 are parameters.

The empirical estimation of this model might yield the following results:

(3a) $$\underset{(.21)^*}{Y_1 = .53} + \underset{(.03)}{.10\ X_1}$$

One could then say that, other things equal, participation in the Summer NYC program resulted in a ten per cent increase in the probability that a student would continue his education in the fall. The model can and should be expanded to include other variables which are theoretically related to the probability that one will continue his education so as to get a more precise measurement of the contribution of the Summer NYC program to probability of continuation in education.

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*The numbers in parenthesis are the hypothetical standard errors of the hypothetical partial regression coefficients.

One variation of this model would be to include the socio-demographic characteristics of the persons in the control and experimental (NYC) groups into the model as well as school associated characteristics. In addition to this, one could include the expenditure per NYC participant into the model. Then, the partial regression coefficient of this expenditure variable would indicate the net contribution of a given amount of expenditure to increasing the probability of continuing education. Thus, if

(4) $Y = a_1 + b_2X_2 + b_3X_3$

where X_2 stands for a set of socio-demographic characteristics and X_3 represents expenditure in units of ten dollars and the other variables are defined as in equation (3) above. The estimated relation then might be

(4a) $$\underset{(.08)}{Y = .30} + \underset{(.08)}{.20X_2} + \underset{(.001)}{.003X_3}$$

In this hypothetical case, for each ten dollar expenditure on a student in the Summer NYC program, the probability that one would continue his education would increase three-tenths of one per cent.

This relationship, of course, is not a cost function. The estimation of a cost function for the Summer NYC program would be as follows:

(5) $Y = a + b_1X_1$

where Y equals the total cost of a given Summer NYC program based on pricing out the inputs of the program's production function, X_1 equals enrollment in the program and a and b_1 are parameters. The partial regression coefficient b_1, would display the marginal cost of enrolling an extra participant in the program. This is a linear function as expressed. Since the total cost function may not be linear, other functional forms may be estimated to arrive at the most correct form, given the data, the program, and the underlying economic theory.

There may be several different approaches to achieving the objective of the Summer NYC program. Each of these will have its own production function and its own cost function. If the success of each of these alternative techniques in promoting the continuation of education is equal, that technique which has the lowest marginal cost will be the most efficient one to use. It will be more efficient (or effective) in the sense that a given level of attainment of the project objective can be obtained at the lowest cost outlay.

If the alternative techniques have both different costs and different degrees of success in fostering the continuation of education, then the differential failures (the dropouts) can be treated as production rejects, implying that one technique is more costly or causes more "waste" than another. Then, as long as the socio-demographic characteristics of the participants as well as school characteristics for the different techniques are the same, one can still make a proper choice of the most effective program.

However, it is certainly not likely that the school characteristics and socio-demographic characteristics of the program participants will be the same among the alternative techniques being evaluated. In such a situation, multiple regression and correlation analysis can provide information, based on an appropriate theoretical model, to identify those variables which have the greatest relative net effect on the output variable. Sub-sets of program participants can then be developed based on this analysis. For instance, it may turn out that race, sex and IQ have the greatest relative impacts on probability of continuing one's education. Then, among the alternative techniques of the Summer NYC program, the marginal costs of white males with IQ's falling in a range from 100 to 110 could be compared between alternative techniques. This could likewise be the case for other possible combinations of personal characteristics among the NYC participants. One might then discover that one technique is more effective (the marginal cost per continuing student is less for one technique) given one type of participant (say, white females with IQ's of 100 to 110) but that it is less effective for another type of participant (say, Negro males with IQ's greater than 100). Finally, if efforts to standardize the characteristics of the participants are not made, then one will not be able to tell whether the differential marginal costs between techniques are due to the different production functions of the techniques, the different characteristics of the participants, or interacting combination of both. The analysis will be inconclusive.

Examples of Empirical Analysis. A variety of economic and statistical analysis of educational programs has been performed. Two such studies are considered here. High School Size and Cost Factors[1] and Equality of Educational Opportunity[2].

The study by Herbert Kiesling is of interest because the analytical model he uses in the study is similar to one of those suggested below. He postulates the following model:[3]

$$Y_i = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

where

Y_i is the measure of quality

X_1 = verbal Knowledge of Factor Score (Intelligence)

X_2 = expenditure-per pupil in ADA

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[1] Herbert J. Kiesling, High School Size and Cost Factors, Final Report, Project No. 6-1590, U.S. Office of Education, March, 1968.

[2] James S. Coleman, et alia, Equality of Educational Opportunity, Washington, D.C.: U.S.G.P.O., 1966.

[3] Kiesling, op. cit., p. 33.

X_3 = high school size in ADA

X_4 = average value of the socio-economic index for pupils in the population for which Y is applicable.

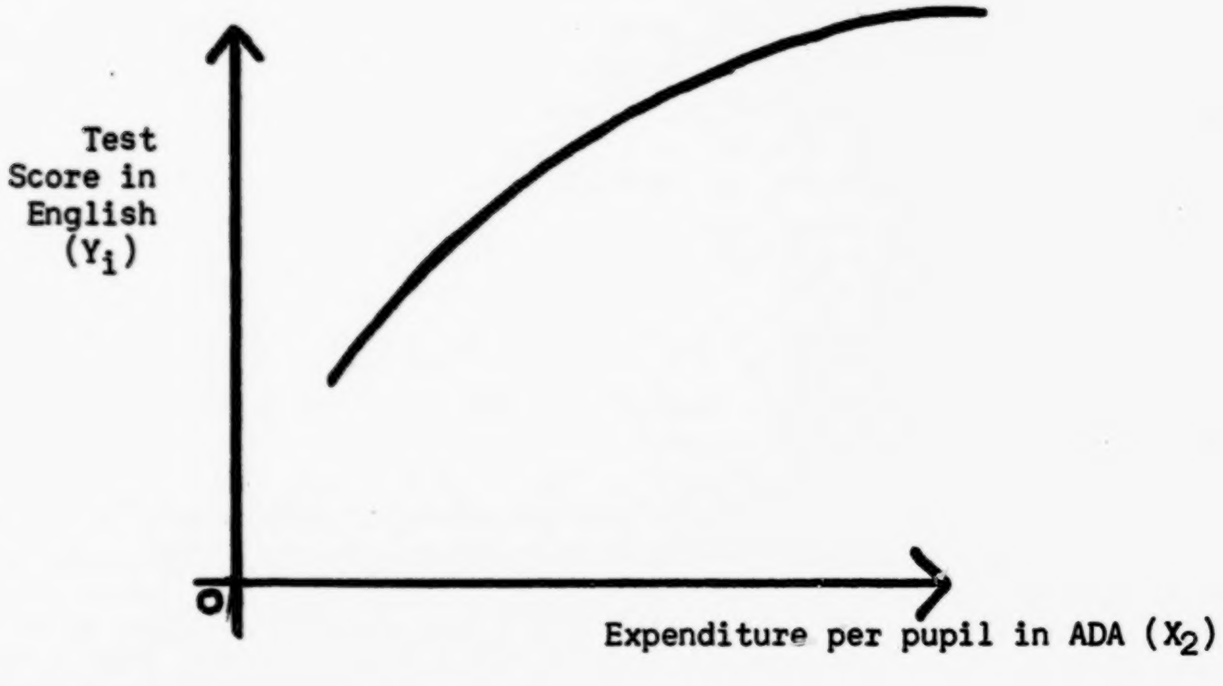
e = an error term

Kiesling argues that he is attempting to measure school quality. From a decision making standpoint, an attempt to measure "quality" by itself is not too meaningful. Given that extra expenditure will yield extra quality, the question still remains as to how much extra quality to incorporate in a program, or which program of a given quality to adopt.

However, to continue, his measures of "school quality" are of three types. One of these three quality measures are multiple choice question tests constructed along subject lines which include English, Mathematics, General School (academic subject) Aptitude and General Technical Aptitude.[4]

In simple terms, the relationship between his quality variable and his expenditure variable may look as indicated in Figure 1. Here, he is actually dealing with an index of output, test performance, as well as an index of quality. What is shown here is that as expenditure increases, test performance increases at a decreasing rate. A way of looking at the quality problem more consistent with an economist's viewpoint is to compare relative test performance of pupils being taught by different techniques but at the same marginal cost outlay for each technique. Then, that technique having the highest relative score can be said to be more efficient or effective.

Figure 1: Hypothetical Relationship between Y_1 and X_2, Net of the Influence of X_1, X_3 and X_4.



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[4] Ibid., p. 8.

In short, in the strictest terms his study shows the net change in test performance for a change of a given unit of expenditure but this doesn't tell one how efficient a particular school is in teaching that subject to a student. And of course, expenditure itself is not a measure of quality, since different expenditure levels may simply represent different combinations of teaching inputs among alternative techniques while saying nothing about the resulting output levels among techniques. To summarize the findings of Kiesling, the estimated relationship between test performance and expenditure appears in general to be linear and upward sloping though in some cases the new relationship is similar to that expressed in Figure 1 below. Finally, he states that[5]

> After allowing for these control variables (X_1, X_3, and X_4 above), it was often found. . .that an additional $100 of expenditure per pupil (in ADA) was associated with between .1 and .2 of a standard deviation in the dependent variable. This is no small effect.

What does this $100 of expenditure represent? It represents the average input mix of instructional inputs for either the sample as a whole or for the sample subsets for which he estimates relationships. The reader does not know what this input mix is. And, he has no information on how changes in the input mix that can be bought for $100 will affect performance scores. Thus, his statement "This is no small effect" does not have any meaning. Small relative to what?

Of course, Kiesling's study is not a cost-effectiveness study, so that this criticism is to an extent unfair. But the criticism is not unfair to the extent that Kiesling purports to be discussing educational quality.

In contrast, the Coleman Report (Equality of Educational Opportunity), which is based on the same project talent data which Kiesling uses, finds[6]

> . . .that social composition of the student body is more highly related to achievement, independently of the student's own social background, than is any school factor.

Further, the findings can be summarized as expressing the phenomenon that[7]

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[5] *Ibid*., p. 132.

[6] Coleman, *et al*., *op cit*., p. 325.

[7] Samuel Bowles and Henry Levin, "The Determinants of Scholastic Achievement--An Appraisal of Some Recent Evidence," *The Journal of Human Resources*, Winter, 1968, p. 4. See also Coleman's reply to this critique in the Spring 1968 issue of the same Journal. Also to be published by Bowles and Levin in the Summer 1968 issue of the same Journal is their, "Equality of Educational Opportunity: More on Multicollinearity and the Effectiveness of Schools." Forthcoming.

> per pupil expenditures, books in the library and a number of other facilities and curricular measures show very little relation to achievement if the social background and attitudes of individual students and their schoolmates are held constant.

Thus, while different subsets of the same data set were used, the two authors come to contradictory conclusions. The difference is, in part, due to the fact that the Coleman report includes a considerably larger number of independent variable in the estimated equations. But, perhaps the difference is more apparent than real, since as Bowles and Levin point out, the Coleman Report finds a significant relation between achievement and teacher's characteristics. And teacher's characteristics account for 75 per cent of the variation in teacher's salaries. And teacher's salaries dominate the institutional expenditures category.[8]

Also, Kielsing used a dummy form for his expenditure variable, breaking expenditure into $50 ranges. The Coleman Report used a linear continuous variable form. There is some evidence that the empirical functional relationship between performance and expenditure is not linear. Economic theory would support this non-linear relationship on a priori grounds also. Thus, if Kiesling's formulation more closely approximates the true functional relationship, which it probably does, his estimations will have a higher degree of statistical significance.

Also, the manner in which the regression analysis was conducted imparted a bias to the findings on the relation between achievement and expenditure in the Coleman Report. The technique in the Coleman Report was to add each independent variable in a stepwise fashion and then display the difference between the coefficient of multiple determination for the equation with a given variable in it and the coefficient of multiple determination for the same equation but excluding the variable in question. This procedure is only valid if the set of independent variables are completely independent of each other. But such is not the case for the variables in this study. School characteristics, student characteristics, and expenditure levels are all intercorrelated. Thus, the order in which variables are introduced into the equation will affect the observed difference in the coefficients of determination. It is then possible to structure the order of independent variables so that, say, variable two which is added after variable one, but which is highly correlated with it, adds little or nothing to the explanatory value of the overall relationship. Finally, the Coleman Report does not display the partial regression coefficients so that one cannot determine the amount by which a unit of expenditure effect test performance.[9]

Neither of these two studies provides the data analysis necessary to make choices among competing educational alternatives, though the Coleman Report presents information which would tempt one (erroneously) to make economic judgments. Of the two, the Kiesling study appears to be more consistent with the needs of economic analysis.

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[8] Bowles and Levin, "The Determinants of Scholastic Achievements," op. cit., p. 10.

[9] Ibid.

Summary. This paper presents a general framework for evaluating developmental and other types of educational projects. The framework is presented in the context of economic analysis, sometimes known as systems or cost-effectiveness analysis. It can deal with efficiency problems concerning both economic and non-economic outputs. It can be applied, and should be, to any situation where choices among alternatives are being made.

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The Economic Evaluation of
Development Projects in Education

Reaction To The Stromsdorfer Paper

by George Maccia

Professor Stromsdorfer has pointed to the limitations of use of economic theory in educational development programs. He also indicated the necessity for having knowledge of the net effect of developmental programs on the persons involved. To obtain such knowledge we need to know which students are affected by them. Professor Stromsdorfer asserted that techniques to measure this net effect directly do not exist. Thus, he offers an indirect approach by way of an input-output systems analysis in which techniques of cost-benefit analysis are used, with regression equations as instruments of measurement, and economic efficiency as the criterion of programmatic achievement. As we are all well aware, regression equations never tell us about any ostensibly present individual. What we get from them are estimates of the likelihood of some indefinite individual who is more or less likely to be represented in a defined class of ostensibly present individuals.

I cannot, of course, comment on the adequacy of Professor Stromsdorfer's model as a model for analysis of economic programs. I am troubled, however, by an implicit assumption that educational phenomena are generally, if not totally, reducible to economic phenomena, with the instruments of one transferable to the other. He rightly rejects the pretest-postest form of analysis, once so popular in education, as being of little worth. He proposed group comparison analysis, but does not warn us of the legions of difficulties in this approach. He enjoins us to tie our analyses to specified performance objectives and to evaluate educational development programs after meticulously fastening our operations to those objectives. We have often done this and have found that interaction variation in system functions which are not specifiable through the selected objectives could not be discerned while it was happening. The approach (utilized in most AID programs) has been a model of disaster. This form of systems analysis is subject to the "thalidomide mistake". It cannot be otherwise, for such "side effects" are not covered either by the objectives selected or through regression equations comparing inputs to outputs. What we do need is a general strategy for educational development which has available an adequate descriptive and explanatory educational theory. Through such a strategy and theory it would be possible to discern "side effects" arising from a decision to optimize specified educational outcomes. Lacking such a strategy and theory, we might do well to abandon group analysis and seek that instrument which can predict whether Johnny will "drop-out" or continue in a given educational program. Despite what Professor Stromsdorfer avers, there are instruments available for identifying the potential drop-out Johnnies. These are teachers with long experience with students from given socio-economic groups.

Reckless and Dinitz* recently uncovered the research and developmental value of such instruments. They were not interested in the potential drop-out, however, but in potential delinquents, as defined by the courts in Columbus, Ohio. In trying to predict which students in a given population would be judged by the courts as delinquent five years from the time of their measures, they developed regression equations utilizing socio-economic factors and test results. They also asked teachers with ten years experience in teaching such students who they thought were the potential drop-outs. The best estimate yielded from the application of regression equations was approximately 70%. The teachers' accuracy ranged from 90 to 95%. Perhaps if we ask teachers the right questions, calling for predictions of Johnny's behavior, rather than reasons for Johnny's behavior, we may have that instrument which will yield predictions which enable us to devise techniques for ascertaining the net affect of developmental programs of education. If we selected our best such predictors we then could more readily interpret economic efficiency in terms of Johnny, rather than Johnny in terms of economic efficiency.

Discussion

Following the opening remarks and orientation to the conference purposes by the conference leader, Dr. Maxwell, Dr. Stromsdorfer began the presentation of his paper. The discussion which it generated prevented him from getting very far into his paper. This discussion included the following points, topics and questions.

1. The "efficiency" and "effectiveness" of developmental projects in education were defined. "Efficiency" is the program's ability to optimize a specified utility function. Systems analysis takes into account all measurable costs and expenses in terms of monetary units. If monetary values can be assigned to outcomes, efficiency can also be expressed as investment returns. At present, economic analysis is limited by our ability to place a monetary value on all pertinent educational costs and outcomes. "Effectiveness" of a program is the extent to which it achieves all of its relevant outcomes, both economic and non-economic. Cost-effectiveness analysis is employed as an evaluative tool when either costs or benefits cannot be expressed in purely monetary terms.

2. Tentative probes were made at defining "developmental" projects. The trilogy of research, development and operation was advanced as a useful classification of educational activities. (Dissemination was also mentioned as a separate form of activity at a later point in the discussion.)

3. The output of research was postulated to be knowledge,while the outcome of development was thought to be a process or product immediately applicable to the school situation.

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*In Interdisciplinary Problems in American Criminology. Papers of the American Society of Criminology, 1964.

For a complete analysis of this work see additional papers referenced in Criminal Law and Criminology 55:515-523, 1967.

4. Development involves engineering or designing processes or products that can be installed in an operating system to accomplish the ends of that system. Development utilizes the results of prior research or practice by applying knowledge in new ways or in new combinations. It is a process for effectively operationalizing our educational knowledge.

5. It was felt that there is an inevitable relationship and even overlap between research, development, and operation.

6. The role and potential constraints of setting project objectives early in the developmental process were discussed. The complexity of the developmental product, as perceived by the developer, is instrumental in determining the degree of specificty with which he can, or is willing to, state expected outcomes at the start of the project.

7. No consensus among the conference participants was reached regarding the above points.

Some Decision Points And Alternatives In Developmental Curricula

A Paper Prepared For

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A summary identification of decision points and alternatives in developmental curricula.[1]

While there is a multitude of differences among the various developmental curriculum projects[2] that have been functioning at some time during the last 10 years, there are many common decision points. Perhaps ways in which projects go about handling these decisions and the concomitants of the possible alternative courses of action provide a framework for describing the developmental curriculum project movement as it presently exists and for identifying the most promising future directions. (It should be noted that the decision points are not always clearly identified by those making the decisions, and the alternatives available and their ramifications are often not clearly recognized by the decision makers prior to -or, often, even after- the decision has been made.)

Attention to the decision points and alternatives is based on the assumption, not universally held, that an awareness of alternatives improves decision-making, and that deliberate decision-making is preferable to intuitive operations, free from conscious concern with the making of decisions and the systematic exploration of alternatives. While certainly it is possible to push deliberateness in decision-making beyond the point of diminishing returns, rejection of efforts to improve decision-making through analysis may be tantamount to questioning attempts to improve teaching through the analysis of teaching, based on the argument that good teachers are born rather than made. Without substantiating evidence that intuitive decision-making is superior to deliberate decision-making and that there are enough gifted intuitive decision-makers to fill the needs of developmental projects, a clearer understanding of the decisions and alternatives open to developmental projects would seem indicated.

Project decisions can be grouped in a variety of ways; for example, in terms of who makes the decision, the strategy or method of decision-making, the extent to which the decision delimits or circumscribes later decisions, the importance of its impact, or the point in the project's life that the decision is made. The choice among systems for classifying decisions perhaps should reflect the interests and needs of those using it, since one system may be more appropriate for a given purpose than another. In a sense, any such system is arbitrary, since it would be difficult to think of any but the most trivial decision that does not affect -and, in turn, is not affected by- other decisions and other categories of decisions; furthermore, at different points in the life of a project, the alternatives for a given decision may change. For the present paper, the following groupings will be used:

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1. Ideas in this paper are developed in greater detail in Hulda Grobman, Decisions and Processes of Developmental Curriculum Projects (Forthcoming).

2. For the purposes of this paper, developmental curricula will include the efforts similar to those of various groups over the last decade, to produce new curricula through group activity, and with trial use of experimental editions of materials during the developmental period, and feedback from such use to improvement of materials. For a more complete definition, see Hulda Grobman, Evaluation of Curriculum Projects, AERA Monograph Series on Curriculum Evaluation No. 2 (Chicago: Rand McNally, 1968)

- Situational considerations
- Administrative arrangements
    - Source of funding
    - Structure of the organization
    - Personnel involved
    - Politics of the organization
    - Life span of the project and/or parent organization
    - Project housekeeping
- Curriculum decisions
    - Purpose of the developmental curriculum
    - Parameters of the project's job, nature of materials produced and target audience
    - Basic educational philosophy, psychology of learning, and assumptions underlying curriculum and organization
    - Preparation of materials - process and timetable
    - Format of the curriculum
    - Method of release of materials
    - Evaluation of the curriculum
    - Training for use of the curriculum
    - Implementation of materials following completion

Within this system, the categories are not discrete and the order of categories is not necessarily sequential. Thus, the system is intended as a handy framework for analysis rather than as a fixed taxonomic structure. "What are the variables?" and "What are the concomitants?" are different questions from "What are the earmarks of a successful developmental project?" and "Which projects are more successful?" It is the former questions that will be dealt with here. No attempts is made to select a "right" or "best" decision or set of procedures, and perhaps no single approach is optimal. However, simply the clarification of decisions and variables in the situation may be useful as a starting point for discussing optimal strategies.

The author is not attempting a complete census of alternatives, but hopefully a large proportion of the more important variables are included. For each section, there is generally a brief listing of some of the variables, and a few exploratory notes and ideas. These notes are intended only as indication of some ramifications, since time and space limitations preclude a more complete consideration here. Sections are not mutually exclusive and there is some duplication of items among sections. Some of the sections are more fully developed than are others, not necessarily because of varying complexity or importance, but perhaps because the author has clarified her thinking more in some areas than in others.

SITUATIONAL CONSIDERATIONS

Public opinion, political tenor of the country, and various temporal factors are influential in project activity; since these vary from time to time, the greater success of a given venture may be a factor of timeliness rather than other variables in the situation. For example, after Sputnik, large scale funding was available only for science and mathematics projects at the senior high school level. Today, projects concerning the disadvantaged perhaps have the best opportunity for major funding. Further, the purposes and procedures of a developmental curriculum project may be quite different when it is among the first such projects ever tried (e.g. PSSC, BSCS, UICSM, SMSG) or when some relatively successful patterns have already been established. Another important variable is whether it is the first venture in a subject area for a given target audience; thus, the situation of Harvard Project Physics, in preparing a senior high school physics course, is far different than it would be had not PSSC preceded it.

ADMINISTRATIVE ARRANGEMENTS

Source of funding

Public (OE, NSF, state, local school system)/private (foundation, publisher, business, other)

Duration of grant or funding - short term/long term

Structure of budget - flexible/rigid

Timing of grants and overlap of grant period with organization's fiscal year, and with school year

Expectation for continuation of funding and level of continuing funding beyond individual grant period

The restrictions and ramifications of funding through different sources are generally not recognized by those who have not had direct experience with one or more funding sources. The funder's guidelines for programs, the delays in awarding grants, the cliff-hanging while awaiting grants, the time and difficulty in shifting funds from one function to another, the lack of guarantee of continued financing beyond the individual grant period, the length of grant periods and the time required in proposal writing and obtaining grants very clearly modify what is possible, may preclude certain types of operations and may, in fact, dictate the kinds of materials produced even when the funder has no such desire.

Structure of the organization

General or multipurpose organization (university, R and D center, Regional Laboratory) / specialized-purpose group (to develop one curriculum). Multipurpose groups include: various curriculum jobs in one subject area; various curriculum jobs in various subject areas; curriculum and other work in one subject area; curriculum and other work in various subject areas.

Is initiator and developer the same person

Who decided purpose of project

Who makes value judgments

Power structure of project - who makes what decisions

Communications - within project/with outside

Formal and informal penalties and rewards for bad and good decisions

History and tradition of project (e.g. pioneering/stolid) - who started the project and why

Image projected by project ("messing around", "creativity","Piaget", "inquiry")

Geographic area - local/state/regional/national - centralized/decentralized

Degree of control by a parent organization or outside group (e.g. professional organization, university, etc.)

Age of organization and point in the life of the developmental project

Degree, nature and frequency of quality control interventions

Projects vary tremendously in terms of organization charts, from the centralized National Curriculum Projects to the decentralized Developmental Economics Education Project, which involves a national, umbrella organization, but only very loose control and some central financing and complete decentralization of developmental work. Organization as indicated by organization charts is only one dimension of organizational differences, since charts may not reflect actual power and communication channels which may be the major determinants of project success. (National curriculum projects or Regional Laboratories with identical organizational charts may differ widely in terms of actual day-to-day communication and decision-making.) These in turn may reflect the personality of the project director.

How does organizational structure affect quality control? (To what extent is quality control desirable - problem of maximum return on investment vs. desire for experimentation and diversity.) Is planned change and dynamic innovation more likely with some types of organizational structure than with others? Some observers (e.g. Bennis, Changing Organizations) feel that the traditional chain-of-command type of operation is incompatible with directed dynamic innovation, yet some projects operate on a clear-cut, chain-of-command basis, and the school systems for which curriculum materials are intended generally do.

Personnel involved

Selection and personality of the director - did he originate project - is it "his" project

In-house preparation of materials/subcontracting out

Permanency of staff - permanent, regular, year-round staff (full or part-time on project) / special short-term (full-time or part-time) staff/ consultant staff/graduate student staff

Selection and assignment of staff - by parent organization/project/target audience

Permanency of regular staff - rotating or relatively permanent

Nature of staff assignments - specialized/flexible

Background and qualifications of staff - subject matter experts/teachers

Background and qualifications of those developing materials- subject matter specialists/grade-level teachers/science writers/students at grade level

Nature of personnel - research types/educators/administrative types

Location of staff - centralized (in one building/several buildings in same city)/ several different cities

Morale of staff - breaking new ground/simply another job

Conditions of employment - tenure, fringe benefits, professional status

Size of staff

The kinds of personnel and many of the conditions of employment are closely related to the structure of the organization, its permanency and the relationship with a parent organization. For example, in projects in universities questions arise of joint appointments with departments, and whether departmental appointments, promotions and salaries are consistent with those of the project. In Regional Laboratories, given the drastic shifts of activities, is flexibility more important than specific competencies, and what is the effect of this on the project? Will highly qualified persons work without a university connection for long periods of time? What conditions of employment (tenure, for example, in a project dependent on outside funding) will insure the most appropriate talent for the project? How does geographical location (e.g. summer writing conference in Colorado or Cape Cod) influence availability of staff?

Should the project be virtually synonymous with the Director or should it have an independent identity? Should the directorship change over time? What does this do to the project? To the image of the project? To its ability to staff its activities? And to the acceptability of its project?

Projects vary tremendously in terms of size of staff working on a given developmental project, from some 70-80 at a given time to less than half-dozen at a time. The volume and quality are not necessarily directly correlated with numbers. What are the advantages of large and small groups? When is the larger group justified? When is it more effective?

Politics of the organization - external and internal

What is the external control over the project

What are the external influences (White House, Congress, OE, financial backers, profession, public school systems, state departments of education)

What is the power structure of the target audiences

What is the power structure of the developmental project

What personalities are involved in decisions

What compromises must be made, with whom and why

To what extent are decisions payoffs for other favors

Are failures permitted

What are the communication networks within the organization, with outside organizations and with the target audience

Who makes what decisions (handed down decisions/pseudo-sharing/shared)

General project morale (including past successes and failures)

Point in life of the project (pioneering/old, dying project)

Personality of power figures

These are closely linked to the "Organizational structure" and the "Personnel" areas. It is included separately to emphasize the importance of values, attitudes and pressures in determining structure and personnel decisions, as well as decisions in other areas, even though such decisions are often justified on other bases.

Life span of a project and/or organization

Uni-purpose organization/multipurpose organization including specific developmental curriculum work

Broad purpose/limited, specific purpose

Deliberate decision to continue/deliberate project internal decision to be a one-time effort/outside decision to cut off project

Greater efficiency of continuing projects and organizations/greater creativity of new projects

When should a project die and who should make this decision

The life of a developmental project may be decided at the initiation of a project to be a relatively short-term one (e.g. preparation of specific materials in one subject area for one or a few grades), a continuing one, or no deliberate decision may be made. For many projects, initially there was no clear expectation concerning the duration of the project. Other projects have changed from relatively short term ones to longer ones as work progressed and the project self-image changed. Some projects - such as those in regional laboratories or curriculum laboratories - are part of continuing organizations which have as a major purpose the continuing development of curriculum.

The question of project life span involves some basic issues in terms of efficiency, effectiveness and long-range educational desirability. When a project has once prepared a curriculum or carried out some developmental function, what are the gains in efficiency in going to another similar job? Over time, do some projects become more efficient and/or effective than others? Should this be a criterion for continuing? Are continuing projects more likely to institutionalize earlier innovations or arrangements so that they cease to be highly creative? Can an established project be as innovative once it has developed a successful formula for curriculum materials? Can long-term projects continue to attract the high quality personnel new projects have attracted in the past? What rewards are needed to maintain staff quality over long periods of time, particularly where the project does not have close professional ties, as with a university or professional association?

Project housekeeping

While adequacy of housekeeping details does not make a project excellent, lack of concern with detail can burden or delimit a project. Some projects operate on a businesslike basis, providing a level of accommodations and managerial services to staff, visitors, teachers associated with tryouts that are not normally associated with educational projects. This is not a matter of luxury spending, but rather includes such items as adequate secretarial service, facilitating transportation, freeing professionals from non-professional tasks and paying people for time spent above normal professional teaching assignments. Other projects have operated on a shoestring budget, in much the manner to which university and school personnel are accustomed, scrounging supplies, saving money (while wasting time) waiting for buses when a private car would save hours, and working on time stolen from regular jobs. The latter procedure saves considerable money and nonetheless produces a product-often a very good product. What, then, are the advantages and justifications for spending far larger sums for more adequate housekeeping arrangements, larger staffs and larger work periods? Does the project differential - if any - justify it? Do any other outcomes justify it?

CURRICULUM DECISIONS

Purpose of the developmental curriculum

Mission-oriented (e.g. teach disadvantaged to read)/general theme (improve math education or better prepare students for college)

Detailed, behavioral-objectives oriented/more general, nonspecific statement of purposes

Focus - on change in materials used in the schools/change in subject area coverage/change in teacher behavior/change in student immediate behavior/change in student long-run behavior/change in student values

Orientation - process/skill/content/values

What levels of cognitive skills are involved

Projects vary in degree of specificity from the very general (e.g. desire to "improve mathematics education") to the very specific in terms of audience (e.g. disadvantaged, urban preschool) and skills to be taught (e.g. upgrading readiness scores by x points, as measured by standardized tests). This in turn delimits the type of personnel, the nature of job assignments and priorities, and scope of materials turned out, the funding possibilities, and the freedom for exploratory ventures.

Parameters of the project's job (the project's definition of its role), and the nature of the materials produced and a target audience

Definition of curriculum and its ramifications - narrow (the curriculum = the textbook)/broad, all-encompassing view of curriculum

Target audience
- Students- bright/average/slow
- Teachers- well-prepared/average preparation/minimal preparation
- Schools- well-equipped/average equipment/minimum equipment
- Trainer of teachers- subject matter specialists/Educators; at graduate level/undergraduate level; university/college/junior college

Decision to prepare materials/no materials prepared

Type of materials prepared
- Student/teacher/trainer of teachers
- Basic/supplemental
- Sequential (including skills taught earlier)/independent units learning and teaching materials needed for course
- Degree of curriculum engineering
- Prescriptive/suggestive
- More materials than teacher needs, to permit choice/less than teacher needs, requiring filling out
- Single medium (e.g. text or film/multimedia)
- Radically different materials/modest change/combination of old and radically new
- Implementing of existing syllabus/breaking new ground/combination
- One subject area/many subject areas at same grade level/one subject area at several grade levels/several subject areas at several grade levels

Interdisciplinary approach/multidisciplinary approach/unidisciplinary approach
Extent of teaching of tool skills non-specific to the subject area (e.g. communication skills)
Supplement existing materials/replace existing materials
Grade level - same as before/changed grade level/ungraded
Individual progress materials/class progress materials
Materials that are self-sustaining or can be taught by present teachers/require some teacher special preparation (e.g. a teacher guide)/require substantial teacher retraining
Subject now taught as discrete discipline/subject not now taught or not now taught as a discrete discipline

Concern only with preparation of materials/concern with implementation of materials

Target audience
    Local/regional/national/international
    College-bound/vocational
    Suburban/urban/rural

The decisions about what the project is going to produce reflects various assumptions about the purpose of schools in a democratic society, who should be educated and for what, how students learn best, and a relative hierarchy of values. For example, a decision to produce discrete units rather than sequential materials indicated either a lack of concern with transferability of skills or a tacit rejection of the notion that transfer is more effectively taught by giving increasingly sophisticated practice in a variety of situations (i.e. spiral curriculum). The preparation of prescriptive materials might indicate a lack of faith in competency of teachers and/or a belief that fundamentally all students learn in the same fashion. The decision to prepare only student materials and a subject-oriented teacher guide reflects the assumption that changing the book changes student learning and student behavior in the desired direction. Special teacher preparation institutes limited to orienting teachers to the new subject matter may reflect the assumption that changing subject matter background will change teacher behavior in the classroom. Thus, the project's definition of its role and the nature of the materials produced reflect some basic though perhaps unrecognized beliefs about the purposes of education, how children learn and how behavior is changed. This in turn raises questions of internal and external validity.

Basic educational philosophy, psychology of learning and assumptions underlying the curriculum and the organization

Time orientation- the past/present/future

Concern with present society needs (utilitarian)/future society needs (social reconstruction or simply what will the future require)

Faculty discipline theory of learning/other theories of learning

Concern with present student needs/concern with adult needs

Concern with motivation/unconcerned about building motivation

Democratically oriented (uniquely suited to schools in a democracy)/ suited to any modern society

View of purpose of schools in the United States- college preparation/job preparation/personal adequacy now and in the future/citizenship in a democracy/general cultural background/preservation of heritage/rebuilding of democracy

Views on how children learn most effectively

Views on how children retain skills and knowledge best

Concern primarily with the cognitive domain/concern at least equally with the affective (attitudes-values) domain

Some assumptions inherent in the materials and their implementation include--

Children are basically different/children are basically the same

Children learn in different ways/all children can learn in the same way

Subjects should be learned for their cultural value/subjects should be learned as prerequisites for further learning

Each subject area is responsible only for development of knowledge and skills in its area/all areas are interrelated and should be mutually supportive and consistent in approach

Knowledge *per se* and tool skills are important/higher level cognitive skills are important for all students

Teaching of values is important/teaching of desired values will come automatically as byproducts of other education. Teaching of desired values can be done in units developed for this purpose/teaching of values must be approached in other ways

By and large, the broader implications of the materials being produced in terms of purpose of schools in a democratic, modern society are not considered, and the possibilities of functional and dysfunctional outcomes not included in the stated intents of the project are overlooked. Thus, developmental curricula are generally viewed as relatively discrete entities, sometimes concerned with sequence within the subject areas from grade to grade and sometimes not, but rarely considered as part of a complex, ongoing social structure in which each part regardless of subject focus of necessity influences every other part.

Preparation of materials - process and timetable

Short term deadline on materials preparation/open-ended effort

Preparation of experimental trial editions/immediate work on final edition

Tryouts during writing period/tryouts at end of writing period/no tryouts

Single writer/coauthors/writing team (large/small)

Degree of communication among writers and with others during entire writing period

Who prepares outline or story line and when (in advance of hiring writers and/or making writing assignments

Feedback channels during writing period

Who handles materials last

While the "writing conference" or team method of preparing materials is one of the earmarks of the curriculum project movement, there is wide diversity in the method of approach to the "team", with varying outcomes. Some teams are made up exclusively of subject matter specialists, some of relatively untrained (in the subject area) teachers at the grade level for which materials are being prepared, some of combinations of specialists in subject matter and well-trained teachers, and some include science writers. Some "teams" are really independent efforts of individuals given discrete writing assignments, with the writings then amalgamated and called a team product. Some teams work in close proximity, with a high degree of formal and informal interaction and constant feedback; for others, while the writers may see each other constantly, there is virtually no feedback on the product until completion. In some teams, there is a status hierarchy, with the subject matter people at the top, the teachers at the bottom, and the ranking of the subject people is by professional stature; for others, there are no status barriers in the work.

The question of productivity of the project does not appear to be directly related to the number of participants in the writing or to the length of time alloted to the writing. On the contrary, for some projects, the lack of a firm time limit on the writing (such as a summer writing conference would have) may be a barrier to completion of materials.

Format of materials

Hard cover/soft cover

Expendable/reuseable

Several separate items (e.g. lab manual, text, workbook)/one unit combining all materials

Format - cards/looseleaf/bound

Quality of reproduction - commercial quality (printed, color, etc.)/ economy type

Media used - text/lab/programs/computer assisted instruction/games/films/ loops/etc.

Method of release of materials

Public domain/private domain

Who holds copyright

Who gets royalties

Who distributes materials - project/university press/commercial press

Free licensing

The format of materials and the method of release, particularly the question of who holds the copyright and the disposition of royalties are "sleepers" in a sensitive situation. While few recognize the import of these items in terms of availability, acceptability and diffusion of new materials, a project whose function is the development of new materials can hardly be successful without eventual acceptance of its materials in the marketplace? Simply the ambiguities and uncertainties of the copyright question for materials produced with grants from Office of Education or National Science Foundation can severely delimit the availability of materials to consumers.

Evaluation of the curriculum

Systematic, formal evaluation/informal, nonstructured evaluation

Short-term evaluation/long-term evaluation (longitudinal and follow-up studies)

Formative evaluation/summative evaluation

Microevaluation/macroevaluation

Evaluation of product/evaluation of process

Internal self-evaluation/external evaluation by others

All projects evaluate in some fashion, but often the evaluation is informal, unsystematic and perhaps even unrecognized as evaluation. There is a wide variation in the degree to which evaluation is formalized, in the evaluative techniques used and in the ways in which these are used. Radically new curriculum evaluation techniques are emerging slowly as there is recognition that many of the traditional approaches to educational research are inappropriate for developmental curricula. However, in many instances the new approaches are still relatively crude and even where data are carefully and imaginatively collected, their use is generally non-systematic and far from optimal. Thus, while projects are learning to collect feedback of various sorts for purposes of improving their experimental projects - a major departure from traditional methods of revising materials - they have not yet learned how to use it systematically. Furthermore, there has been far more interest in - and more adequate funding for - formative evaluation than summative evaluation.

One of the most difficult of the questions concerning evaluation of developmental curricula concerns selection of appropriate standards to use for evaluative purposes, and whether the target audience accepts these standards. If a product is radically different from earlier products, to what extent should prior standards be used for judgment? This is not only a matter of use of standardized tests and other conventional measures of student achievement but extends to such questions as judging teacher performance in the Individually Prescribed Instruction (IPI) program or in an independent study situation and the relevance of achievement measures to attitude objectives and of short-term measures to long-term global objectives.

One of the major innovations of the developmental curriculum movement is the preparation of experimental materials which have tryouts before materials are issued for general use. The method of tryout varies in terms of:

with whom (nature of students)
by whom (nature of teachers)
for what purpose
how long
how many times
when (at what stage of materials tryout)
feedback from whom (staff observers/teachers/students/etc.)
degree of change possible at this point (i.e. to what extent are materials jelled)
degree of control over tryout conditions

Some projects use "instant children", children available on short notice to try out small segments of materials for feasibility. Some wait till preliminary materials are completed and then try them out during the regular school year, either with nearby schools or with schools in a broader geographic area. Some projects depend primarily on staff observation for feedback; others depend more on teacher reports of tryouts. Some have staff members do the teaching for the earliest tryouts; others use regular teachers with special orientation preparation; and still others use regular teachers who have no special orientation beyond some written teacher material. Some tryouts are genuinely concerned with feedback; others are window dressing, so the potential purchaser can be told that it has been successfully taught in situations similar to his.

Training for use of materials

None needed/self-training materials included/special training required or advisable

While training is required or advisable-

- Who does training - project/other
- Who selects trainers - project/other (e.g. founder); what are criteria for selection
- Background of trainers- subject specialist/Educator
- Who selects trainees - project/other (e.g. founder, university); what are criteria for selection
- Length of training - short course/extended period
- Timing of training - before teaching/during school year/both before school year and during school year/both before and after school year
- Orientation of training - subject matter orientation/methods orientation/ combined subject matter - methods orientation

Implementation of materials following completion

Some projects have taken as their mission the preparation of improved materials. (This may reflect the tacit assumption that existence of good materials will result in their use and in the change of teaching and learning.) Other projects, either initially or after some experience with materials preparation, have taken a broader concern with materials implementation, including a concern with widespread distribution, appropriate inservice preparation, change in preservice teacher preparation, appropriate use in the schools, extent to which materials are adapted, continuing rather than short-term use, conditions conducive to curriculum change, problems of implementation, etc.

Some Decision Points and Alternatives In Developmental Curricula

Reaction To The Grobman Paper

by George Maccia

One can only applaude Professor Grobman's concern that decisions directing the course of developmental projects in education be reasonable. What will follow her first steps toward a sociology of knowledge of educational development programs will be of interest to all of us. Clearly the delineation of variables is a requirement for an adequate theory of educational development, but such delineation in itself is not enough. As I am sure Professor Grobman is aware, an adequate characterization of the relationship between variables is most essential. Her listings at this time suggest the complexity of such a characterization. I trust she and others will undertake the task of developing adequate knowledge of developmental projects in education.

Discussion

Dr. Grobman made the following comments about her paper.

1. A developmental project creates an emergent curriculum through a systematic process. There is too little concern among curriculum developers (and others) about the aims of education, that is, for making the value judgments reflected in the objectives of developmental efforts. Uncoordinated projects, each dealing with highly specific outcomes relevant to particular disciplines, are very likely not to "add up" to anything very significant, or add up in a unified way. The impact of a single, discipline oriented project is apt to be very restricted. Perhaps we need to change whole school programs if a large overall impact is to be made.

2. There is too little attention paid to considering the negative outcomes of learning.

3. A considerable part of the discussion which followed centered primarily upon two related questions: a) Who makes the value (or large policy) decisions concerning educational goals and how are these decisions made? (It was pointed out that we do not now possess any adequate decision procedure for deciding between values.) b) How broad should the scope of developmental projects be in order to reform schools in desired directions?

A Perspective of Developmental Projects

A paper prepared for

THE DEVELOPMENTAL PROJECT
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University of Minnesota
Minneapolis, Minnesota 55455

by John D. McNeil
Graduate School of Education
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Definition

A developmental project in education is an active, visible effort to carry out a plan which promises to remove a deficiency in some aspect of learner performance. An essential attribute of the definition as opposed, say, to that of a research project is the emphasis upon change in a learner or population of learners. A research project can be characterized as an attempt to close a gap with respect to knowledge in a discipline.

At times, persons in schools engage in a chain of projects which are only remotely connected, if at all, with performance of learners, e.g., campaigns to pass bond elections for funds with which > to finance higher salaries in order > to attract teachers with qualities necessary > to produce desired changes in learners. Many "enabling" projects aimed at intermediate goals don't make much difference in the ultimate performance of learners even though they appear to have a logical connection.[1] When the link between project and learner cannot be empirically established, the project lacks educational validity. For instance, projects undertaken in response to demands of teachers which can best be justified in terms of teacher morale rather than pupil welfare are not valid educational projects. Validity would exist, however, if it could be demonstrated that pupil progress is improved as a result of an intervention that also raises the morale of teachers.

Project Planning

Planning of developmental projects occurs at three levels of remoteness from learners:[2] (a) societal (national, state, and local governments); (b) institutional (school); (c) instructional (classroom). At the societal level a project is in response to a Federal interest, e.g., a job corps project to equip workers with given salable skills and curriculum projects to provide learners with the spirit and content of the disciplines. Usually a National project does not specify the individual learners to be changed but rather names the class of learners eligible for the treatment. Projects drawn at the institutional level have as their target population those who hold membership in the school as learners. A project to change the behavior of parents or teachers, for instance, would not qualify as developmental in education unless it was undertaken to produce corresponding consequences for pupils. When a classroom teacher plans and conducts a developmental project, it is aimed at particular individuals, as in the case of a teacher who devises and tries out a system for differentially rewarding John, Mary, and Jose in order to maximize their participation and achievement.

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1. Gideonse, Hendrik D. "The Relative Impact of Instructional Variables, The Policy Implications of Research," Teachers College Record, April, 1968, Vol. 69, No. 7, pp. 625-640.

2. Goodlad, John I., The Development of a Conceptual System for Dealing with Problems of Curriculum and Instruction, Cooperative Research Project 454, U.S. Department of Health, Education, and Welfare, 1967.

Planning the Project

Problem Identification

The first step in planning an educational project requires that one have a clear expectation as to what learners should be able to do, i.e., a concept of desirable and desired performance in a situation or class of situations--social, intellectual, physical, vocational. Next, data (observations) are collected in order to note the actual performance of learners in the specified situation. The gap between desired and actual performance becomes the basis for formulation of the problem. The decision whether to close or partially close the gap is a difficult one. How much of an improvement in the learner will be satisfactory? How many learners must change? Is it enough to show that a statistical difference will occur in learner scores following a project? Or must one state in advance what constitutes a practical difference by which the findings of the project can be judged as worthwhile? How much of a difference must the project make in the behavior of the learner in relation to the cost of the product before one would recommend that it be used? On one hand, we have the obligation to look at the finished product, e.g., filmstrip, set of procedures, a system of instruction, coming from a developmental project and to ask ourselves: "Does the change that will occur in learners from the use of this product warrant the multiple costs of reproducing, introducing, and using the product with learners?" The planner should consider initially whether the contemplated product, even if it meets his specifications for learner change, would actually be feasible in practice, e.g., if an instructional solution to a school problem is likely to be demonstrated but the anticipated difficulties of acting upon the solution would prevent its adoption, then the project should not be undertaken in the first place. On the other hand, we must ask whether the developmental costs (most likely to be very much higher than the reproducible costs of a finished product) are warranted even if the product turns out to be of no value (learners don't change) and the best that can be said is that the enterprise showed what wouldn't work. Few project developers are able to predict in advance what the results will be. Developers lack normative expectations when dealing with tasks that are not repetitive and with learners who are not uniform. Further, to the extent that new methods and materials are used in solving the problem, one does not know beforehand the power of his innovation. The designer can, however, specify in advance what results he will present as evidence that the project has or has not been worth the time and expense.

Plans for Evaluation

Should plans for evaluation precede plans for solving the problem? We have said that one should state in advance what will constitute evidence that the objective has been reached, i.e., the problem solved. Objectives are clarified when the actual measures to be used are specified: test, semantic differential, guide to observations, interview schedule, and rating scale. It is especially helpful to stipulate the level of acceptable performance by the learner on the instruments chosen. By stating the criterion in advance, one should be better able to analyze (identify) prerequisites required for attainment; thereby increasing the likelihood that the proposed solution includes necessary components. The selection of learning opportunities (means) logically should follow the clear specification of the desired ends. Just as a teacher should offer pupils opportunity to practice behavior relevant to both prerequisite learnings and that demanded by a final test (provided the test represents the teacher's objective), so should activities of a project be relevant to expected outcomes. Analysis of the criterion gives a clue as to what must be present if the solution is to have its intended effects.

Sometimes directors of projects do not act in accordance with the above recommendation. Instead, the activities and procedures are selected before the criterion measures are determined. If one wants to take little risk of failing, this might be a good way to proceed. High performance scores can be obtained by indexing the learning opportunities--activities, material, assignments, etc., with which learners are to engage during instruction, and then selecting these same opportunities (or samples from the total population of opportunities) to form the post-test. The more closely the criterion measures resemble the training program, the greater chance there is of showing that the program makes a difference (is effective). A criterion test composed of items equivalent to those met in training is a "sensitive measure" for finding whatever differences there are because of training. A case in point occured recently when a school developed a project to improve the reading proficiency of children. The proposed solution included a number of innovations such as two teachers working with a small number of children at one time, a wider range of instructional materials, and facilities for self study. In order to maximize the probabilities of showing that pupils learned more as a result of these innovations, a particular tool for measuring change in reading was developed. The tool consisted of 400 test items - items calling for the application of a number of word-recognition and comprehension skills; but all items were identical to those items children would practice during the instructional phase of the project. Prior to instruction, each child received a randomly drawn sample from the 400 items. Mean scores for groups of children were compiled and instruction commenced. After the program had been given, each child again received a sample from the pool of items and group mean scores were again determined. Gains in reading by the experimental group as measured by the pre- and post-test scores (means) were considerably in excess of the control groups who received instruction under conventional arrangements.

The foregoing brief description of item-sampling as a way to bring about close agreement between activity and indicators of project effectiveness gives rise to several questions: (a) Does the technique of item-sampling measure the ability of learners to perform on new and different instances as opposed to memorizing responses to the examples encountered during instruction? In answering, let us remember that a program can demand that a learner apply a principle to new instances, both during training as well as on a post-test. (b) Should success of the project be judged by the planner's own criteria and not by the values of others less directly involved in the planning enterprise? Scriven's distinction between the roles of formative and summative evaluation is helpful here.[3] Data collected to reveal the effects of early versions and initial steps as well as data indicating the power of the terminal product is necessary to development (the guiding of revisions and new formulations), hence the term formative. Such data enables the project staff to modify the proposed solution so that the intentions are fulfilled. Feedback in terms of learner responses to the stimuli presented enroute and on the final criterion measure indicated the degree to which overall results desired by the planners are attained. The role of summative evaluation is to help one (usually a consumer) decide whether the results satisfy a broader range of desirable consequences than those necessarily sought by the planners. Often a non-planner is concerned with specifications which were not of import to the designer, e.g., presence or absence of certain aesthetic and political factors, and comparison of the product on the basis of efficiency and cost effectiveness with products from other projects purporting to fulfill a similar purpose.

Proposed Solution to the Problem

Review of the Literature

What literature should one review?--writings pertaining to the nature of the problem itself and sources treating strategies and research tools for solving similar problems. There are several reasons for reviewing the literature before designing a solution. It may be economical of time to learn how others have met similar problems and with what success. If, for instance, there is a programmed filmstrip already which purports to close a gap of concern to the planner, it should be checked out. There is little value in developing what already exists. Development undertakings in schools are characterized by an absence of cooperative augmenting and revising of existing programs. Extension of the work of others seldom occurs.

Review of the literature also helps one better understand the problem. That is, new dimensions and definitions of the topic may be reported by others that will help the developer make a better task analysis, i.e., identification of prerequisite behaviors necessary for the learner's successful performance. Further, review of instructional variables and selected characteristics of learners is a useful supplement to a review of the literature regarding the task itself. Projects which attempt to change learners indirectly through administrative decisions may find these factors worthy of manipulation: parental cooperation, procedures for teacher selection and appraisal. Solutions which are to be directly applied to learners in the classroom may make use of such variables as the following: number and kinds of examples, competitive versus visual stimuli, oral versus constructed response modes, immediate versus deferred knowledge of results, prompting versus confirmation.

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3. Scriven, Michael, "The Methodology of Evaluation," Perspectives of Curriculum Evaluation, AERA Monograph Series in Curriculum and Evaluation, Rand McNally and Company, Chicago, pp. 39-83, 1967.

Instructional variables have a better chance of showing their power if they are paired with learners of given characteristics: (a) learners with a predisposition for a given style of learning--through reason, space relations, or verbal, (b) learners who have been rewarded or punished in the past for engaging in particular activities such as working alone or with peers (knowledge regarding values held by the socio-economic groups from which the learners come may be helpful here), (c) learners who are exceptional in their chronological, physical, or mental state---blind, deaf, aged, anxious versus non-anxious. We are not asking that the planner consider learner, task, and presentational variables as important in themselves. They must be related if planners are to generate a more effective solution to the problem. Treatment, e.g., instructional procedures and materials, must be linked theoretically and operationally to both task and those characteristics chosen as crucial in describing the target population.

Need for making clear why the solution should produce intended consequence.

This guideline might be unnecessary were it not for the fact that in educational practice projects often fail to show a logical (theoretical) connection between the proposed solutions and the intended outcomes. I suspect that often teachers and administrators have personal motives for undertaking projects which are sometimes more important than their manifest (legitimate or publicly acknowledged) purposes. Faculty have been known to resurrect their old and favorite plans and to offer them as answers to currently popular problems. Some persons may be motivated by the prospect of getting funds to carry out their own pet ideas even if it means paying only lip-service to the problem for which funding is provided. Support for this opinion can be found in the final reports from government sponsored projects which were funded for resolving educational problems but which ended with mere sociological and psychological information. Also the fact that a school system spends a fortune on replacing a set of textbooks when there is no evidence to suggest that the new books will make any difference in either the academic progress of pupils or in attitude toward learning indicates that educational decisions are not always rational, i.e., that the means are consistent with stated goals.

Need for Stating How One Will Know that the Desired Results were brought about by the Plan and not by some Concomitant Factor

We can say that one has knowledge in instruction when he can produce at will desired effects in learners (he "knows"). Although the production of such knowledge if important to the advance of instructional technology (discipline of pedagogy), knowledge is not the chief intent of a developmental project. As indicated previously, we hold that emphasis of a developmental project is on overcoming deficiencies in learners, not merely the production of knowledge in a discipline. It is true that knowledge will often arise from educational projects but to the project developer the solution of a problem is more important than the scientific findings. The use of research procedures to enhance gains by learners, however, is not inconsistent with our position. One does not know when he is on the right track or where to correct his errors without using a method of research. Simplified research designs are necessary for self-corrective feedback. We use pre-tests for determining need for change and for establishing bench marks of learner competency before treatment. Also we must have measures for guiding development and for validating the product and the project. The use of non-instructed control groups, base-line data, random assignment to treatment, and other such accoutrements associated with research should contribute to the quality of developmental studies. Popham's Simplified Designs for School Research[4] is an excellent self-instructional program to help the planner improve his efforts in program development. By using the designs in this booklet, the planner will know to what extent the results are due to the project and the contribution of different components in the program to overall effects.

One recent advance in educational research of special relevance to project development should be mentioned here. This is the practice of administering two or more treatments within the same classroom, as opposed to offering each of these treatments in a different classroom. By administering, for example, two forms of instructional material, randomly assigned to pupils within a classroom, the developer can use the number of pupils in the class as the proper unit for statistical analysis in determining the value of each form. This is not allowable when the developer has presented one form in one class and the second form in a second class. In the between classroom situation, the unit of analysis must be the number of classrooms, not pupils. The chance of finding significant difference when the N is 2 as opposed to 20 is obviously unlikely. It is difficult to equate conditions in classrooms, whereas when two treatments are presented within the same classroom at the same time, extraneous variables are more fully controlled. Developmental studies of an experimental nature carried out within single classrooms should show more positive results from the use of promising variables than where the effects of the treatment are washed out by failure to control for other variables. Once it is shown under controlled conditions that the variable (or its combination with other factors) is important, the project developer can wonder why the same variable does not seem to be vital in less controlled situations, that is, the findings are not replicated. This in turn will lead to the discovery of new variables of importance in the modified situation. Incidentally, because the reward of finding significant differences will occur more frequently when planners use within classroom designs, there should be an increase in the number of developmental projects conducted at instructional levels. The likelihood of finding NSD under the prevailing practice of comparing treatments in different classrooms has discouraged experimental projects at the classroom level.

Improvement can occur by (a) selecting better objectives, (b) designing procedures which maximize desired results, and (c) modifying procedures so that the same results can be obtained in a more economical fashion. By way of example, the conduct of developmental projects at Mexico's National Center for Productivity often includes an attempt to produce the same effect in learners but doing it in less time and with fewer resources. This is consistent with the modern technologist's goal of trying to produce more with less materials and fewer human resources. The attainment of this goal requires a research design. Versions of programs with and without particular components (activities, material, and their ordering) must be experimentally manipulated and results compared.

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4. Popham, W. James, Simplified Designs for School Research, Southwest Regional Laboratory for Educational Research and Development, 1967.

One further argument for inclusion of a research strategy in each developmental project can be linked to a present trend. Currently, Federal priorities in educational developmental projects seem to be shifting from the development of curriculum to the development of teachers and other personnel associated with instruction, e.g., see Education Professions Development Act of 1967. Research might reveal the limitations of this decision. The underlying assumption seems to be that learners will show greater gains if the preparation of the teacher gets more attention. The question as to when a school system should invest more in training its teachers and when to expect a bigger payoff by revising instructional materials can be empirically answered. However, perhaps a more effective policy would be to focus efforts on assessment of teachers rather than either the preparation of teachers or the development of curricular material. Developmental projects are needed to show the value of making sure that teachers are held accountable for the progress of their pupils. Stress of accountability might be an intervening variable provoking practices such as the teacher's willingness to use both new materials and effective teaching procedures which the teacher already has but, under conventional conditions, does not regularly use. In other words, a developmental study with a research design may reveal that progress in pupil achievement is not due to the teacher's lack of knowledge of teaching, nor in the school's failure to provide curriculum materials. It may be that there exists little incentive for the teacher to use what he already knows.

Kinds of Developmental Projects: Implications for their Conduct

Developmental projects differ in their specificity of detail, visibility, and the degree to which they evolve new possibilities. Some projects, such as those concerned with the development of instructional products (programmed lessons), place much emphasis upon specifying detail and attaining reproducible instructional sequences. Other projects put first emphasis upon serving as demonstrations--working models to be emulated and adapted. Newer programs for teacher preparation are cases in point. Guidelines for reviewing Title III proposals tend to classify developmental projects as:

(a) Inquiry -- to formulate new ideas and theories in order to solve education problems.

(b) Invention -- to design, field test, and refine a new instructional program founded on research and theory.

(c) Demonstration -- to demonstrate a model program resulting from the invention process.

(d) Adaptation -- to adapt a model program to local conditions and needs.

Projects which have as one of their central purposes the generating of alternative possibilities invite special interest. They are usually characterized by an effort to put together personnel, institutions, and instructional material that have been independent from each other. Planners who try to create new organizational forms (structures) do so partly to upset tradition, partly to generate new problems, but chiefly to evolve new possibilities. Goodlad's rationale for advancement of education as expressed in his presidential address at the February 1968 meeting of the American Educational Research Association exemplifies the point of view which would foster developmental projects for the evolvement of possibilities. This view appears to be contrary to the position taken in the present paper. Those stressing evolvement do not demand that the effect of an intervention (invention or innovation) be stipulated prior to its creation. Although they do not specify the effect that is to follow, I have a hunch that those who plan for evolvement are dissatisfied if newer possibilities of merit do not emerge from the project undertaken. However, it is not clear to me how accountability is built into such projects. Neither do I have evidence with which to judge the validity of such operations for learners, i.e., that such projects really advance their welfare.

In contrast to the advocates of open-ended projects, the product developer has been quite precise in spelling out the need for objectives in advance and equally specific in providing guidelines for the conduct of such projects. Remember that the product developer is interested in a product which is reproducible in two senses: reproducibility of effect in a target population of learners and reproducibility in the production of the product, e.g., recording film, book, set of directions. Examples of guidelines given to product developers are these:

(a) Specify instructional outcomes sought

(b) Define prerequisite tasks

(c) Be concerned with learners' affect toward the program as well as with achievement

(d) Try out each version with a few learners

(e) Note results and revise the program when it fails to elicit results set in advance

(f) Use a variety of approaches in presenting stimuli and eliciting responses, even go beyond what others have done to get results

(g) Consider the context in which the product will be used. Make the product an acceptable part of the larger system of instruction

(h) Prepare programs only when the objective is important for large numbers of learners

Examples of Problems in Project Development

Two considerations are singled out: one, those pertaining to the conduct of tryout and, two, those related to operational analysis. The subject of tryout raises issues and problems such as the following:

(a) What constitutes an adequate sample of learners? What are the relative values of using small or large numbers of learners in the pilot study?

(b) How can one make sure that the situation in which the tryouts occur is generalizable to the ultimate population of situations where the product will be used?

(c) How can the developer know for sure what he is really trying out? For example, has he controlled for contaminating influences? (e.g., enthusiasm of an assistant which may be provoking important effects.)

(d) Do data gathered from sample lessons (prototypes--sampling part of an envisioned program) allow one to really predict what the ultimate total program will be able to do?

Operations analysis occurs in a larger frame of reference than that which focuses on the development of the particular project. Its purpose is the improvement of procedures for project development. In some instances, these procedures may be generalizable only to the local activity; in other instances, the insight won will be most helpful in subsequent projects of the same kind wherever they are carried on. Operational analysis requires that a record be made during the project by which one can reconstruct the step that seemed to block progress and identify those procedures which enabled the project to move forward. Most of us have observed informal efforts to assess the strengths and weaknesses of one's way of working. Usually these "self assessments" are spotty. How much change in developmental processes might be expected under two conditions:

(a) Those where systematic records (observations) are made of ways of working with accompanying indications of delay and advance in the project;

(b) Those where there are no provisions for formal analysis of what happens and with what consequences during the conduct of the project?

Summary and Conclusions

The comments in this paper reflect a point of view regarding developmental projects in education. This view gives emphasis to the need for designing and assessing projects in terms of changes to be made in learners. It is argued that the practice for judging a project on the basis of external criteria (changes in learners) as opposed to reliance upon some internal quality present in the project (procedures of quality and style) should lead to educational betterment. While advocating the desirability of stating intended outcomes in advance of project planning, we believe that an alternative strategy--that of withholding stipulation of effect until interventions are created--should be examined.

Specific problems in the conduct of developmental projects have been identified along with descriptions of practices for meeting these problems. Guidelines have been given which seem to hold promise for generating solutions to educational problems through developmental projects. It has been advocated that a research strategy appear in each developmental project.

The question now before us is: Can we use the issues raised in this paper together with guidelines proposed and the description of problems and practices to help shape a model of procedure for planning developmental projects?

Discussion

Dr. McNeil presented his paper by touching upon certain selected content. The subsequent discussion included the following comments and questions.

1. It was suggested that we need a topology of objectives for the learner and/or the educational system. The developmental process should not be guided exclusively by pre-determined, desired learner outcomes.

2. We also need to take into account the foreseeable, indirect and concomitant effects of the program on the educational system, as well as upon the student. Knowledge of all of the outcomes and their consequences should affect development.

3. Evaluative procedures should be capable of attributing program outcomes to program characteristics (accounting for other relevant variables).

4. An early consideration in planning a developmental project should be the attempt to make the product acceptable to the education system in which it hopes to function.

5. Research and development projects usually arise from one or more of the following incongruities: (a) Educational inputs and desired outputs; (b) existing knowledge and existing practice; (c) social values and social realities; (d) relative position today and creating the future we would like.

6. Questions related to whether developmental projects should be centralized or decentralized included: (a) How should resources available for a project be distributed? (b) How can quality control be applied? (c) Are adequate numbers of qualified staff available?

7. Quality control during the developmental process asks three questions: (a) Does curriculum content have authenticity? (b) Does the curriculum (or product) achieve its expected outcomes for the target population? (c) Is the project being conducted efficiently? The first two questions are answered by formative evaluation, which should be conducted, at least in part, by persons who work closely with the "writers" or project developers. There may be a conflict among the measures of quality control, therefore, their relative emphasis should be decided early in the project.

Dr. Maxwell opened the evening session by introducing the questions which had been suggested as guidelines for the conference. Question 1 (What is an educational development project?) was discussed with the following points, among others, being made.

1. A developmental project is a group of modified cognitive structures and related instrumentalities designed to increase the effectiveness and efficiency of a given program. The resultant program should have a utility base outside of the cognitive domain of education.

2. Developmental projects produce materials, techniques, processes, hardware, and organizational formats for instruction which accomplish certain objectives, specified in advance, and which are construed to be part of the broader goals of education. The products are immediately applicable with students, yield reasonably predictable results, and contain a certain degree of re-structuring of applied knowledge. The process must also include evaluation.

3. Development engineers knowledge and theory into immediately usable educational systems. It includes evaluation of the product in terms of the achievement of educational goals, and it leads to further research and development by identifying gaps in knowledge and practice.

4. The research process attempts to discover or verify knowledge and to develop or test theory. It concludes with something known.

5. The development process contains a large research component, e.g., evaluation.

6. Development translates research results into usable instructional forms, and provides data on the performance of these forms, such that those who decide upon educational policy and practice can make more rational decisions.

The evening session concluded with no one appearing to be completely satisfied with all of the stated definitions. There was, however, a feeling that the group was expressing the essence of the concept of development, and that it agreed upon that essence.

The Relationship of
R & D to Educational Improvement
An Output-Oriented Model

A paper prepared for

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For several months I have followed the pages of Science attending to the continuing discussions of research and science policy. I have generally concerned myself with the degree to which the policy questions which arise in educational research and development can, must, or ought to be considered as a subset of those which arise for science as a whole. Thus it has been with no small degree of interest that I have read the articles prepared by Philip Handler[1], George Daniels[2], Harvey Brooks[3], Lee DuBridge[4], and Michael Reagan[5].

Coincidental to this continuing dialogue, I have been for the past three years engaged in a general effort to improve the quality, effectiveness, and impact of the research effort in education. No small part of that time has been spent grappling in practice with many of the same kinds of issues as receive explication in the articles cited above. For some months I have been thinking about research and development in education trying to develop a model which would express the different functions within the total research effort, the various sources of initiative for these different kinds of activity, and the relationships among both the functions and the sources of initiative. My thinking has, of course, been in no small measure stimulated by recent debate about the ways in which schools, instruction, and education are likely to be improved most quickly and with the most substantial cumulative and lasting impact.

Reviewing the several statements cited above in terms of their general usefulness for spotlighting and clarifying analogous problems in the field of educational research revealed the particular value of Professor Reagan's analysis as a summary of points of view already advanced and as an identification of the generally individualistic starting point of many of the theoreticians of science and research policy. The model presented in this article constitutes, I think, an instance of exactly that for which Prof. Reagan called[6], namely, a discussion of research and development as seen from the point of view of someone who sees himself as a sponsor, planner, or user of research and development. It was not developed directly in response to Reagan's suggestion; in fact, it was only after a colleague recalled his article with specific reference to the similarity of view on the research and development distinction that I realized how closely what I had formulated came to responding to Reagan's suggestion for some dialog on the part of users of research to more adequately balance that which had been generated by the performers.

One Logical Model of the Change Process

Typically, the context for discussion about research and development for education is a description of the change process in education. Various models of change have been proposed. The one which seems to have the highest degree of currency at the moment places research and development in a linear arrangement beginning on the left with inquiry (research) and proceeding to the right through development, diffusion, and adoption (see Figure I).

In proposing their model, Egon Guba and David Clark called three caveats to attention. First, they noted that the model was constructed on logical grounds and that it was largely unsupported by empirical research. Second, they pointed out that it was not necessary for change to begin at the research or inquiry stage. Third, they noted that the model itself was a uni-dimensional analysis of change roles which are influenced by a multi-dimensional range of variables not entirely accommodated by the model's structure.

As a model of the change process, this particular schema has the virtues of being simple and logical. However, those of us who have worked intensely on problems of research policy in education see shortcomings. The Guba-Clark model does not emphasize sufficiently within its structure that initiative for actions of different kinds can take place at any point in their continuum and that those initiatives may come from locations other than where the action itself is to be performed. Because of its linear nature, and despite the second caveat mentioned above, the model unwittingly implies that innovations begin with the findings generated by fundamental research.

The Output Model

The purpose of developing an alternative model is to create an heuristic which (a) illustrates the essential differences between research and development activities and (b) shows how the two are - or can be - related to one another and to the operating educational system. Such a model ought to illustrate different sources of initiative and motivation for beginning various activities. It should be able to show or imply the interplay among all the functions in the effort to improve instruction and education.

The output model is based on the conviction that research, development, and school operations can be viewed as distinct kinds of activities with quite different objectives or outputs. It is constructed to indicate that initiatives for each kind of activity are the results of decisions based on different kinds of data and equally distinct kinds of internal and external needs. The model implies that while there may be a strong logical flow from the production of knowledge through the development of processes to their installation in operational settings, there may be just as strong a flow backwards as operational problems define development programs, which, in turn, reveal the need for certain basic information and theory.

Figure I. A CLASSIFICATION SCHEMA OF PROCESSES RELATED TO AND NECESSARY FOR CHANGE IN EDUCATION

	RESEARCH	DEVELOPMENT		DIFFUSION		ADOPTION		
		INVENTION	DESIGN	DISSEMINATION	DEMONSTRATION	TRIAL	INSTALLATION	INSTITUTIONALIZATION
OBJECTIVE	To advance knowledge	To formulate a new solution to an operating problem or to a class of operating problems, i.e., to innovate	To order and to systematize the components of the invented solution; to construct an innovation package for institutional use, i.e., to engineer	To create widespread awareness of the invention among practitioners, i.e., to inform	To afford an opportunity to examine and assess operating qualities of the invention, i.e., to build conviction	To build familiarity with the invention and provide a basis for assessing the quality, value, fit, and utility of the invention in a particular institution, i.e., to test	To fit the characteristics of the invention to the characteristics of the adopting institution, i.e., to operationalize	To assimilate the invention as an integral and accepted component of the system, i.e., to establish
CRITERIA	Validity (internal and external)	Face Validity (appropriateness) Estimated Viability Impact (relative contribution)	Institutional Feasibility Generalizability Performance	Intelligibility Fidelity Pervasiveness Impact (extent to which it affects key targets)	Credibility Convenience Evidential Assessment	Adaptability Feasibility Action	Effectiveness Efficiency	Continuity Valuation Support
RELATION TO CHANGE	Provides basis for invention	Produces the invention	Engineers and packages the invention	Informs about the invention	Builds conviction about the invention	Tries out the invention in the context of a particular situation	Operationalizes the invention for use in a specific institution	Establishes the invention as a part of an ongoing program; converts it to a "non-innovation"

Figure II depicts the model. Three planes are shown, each symbolizing the different orientation of activities conducted under research, development, and school operations. (The model is - as are all models - an abstraction from reality. In the real world, these activities are not always neatly separated either in time or location. The point of conceptually - and therefore graphically - separating them here is to illustrate the essentially different orientations of the three types of activity and the consequences of those differences.) For each activity represented in Figure II, the model depicts an initiative leading to an output characteristic of that activity.

The lower plane symbolizes the knowledge orientation of research; the object of research, of course, is to generate new knowledge. And, as is also well understood, one of the significant features of research is that when an activity is begun *the specific outcome is not known*. For research, C represents an initiative undertaken which culminates in a research finding represented by Fc.

The middle plane symbolizes what I call the process orientation of development. The object of development is to produce materials, techniques, processes, hardware, and organizational formats for instruction which accomplish certain objectives, specified in advance, which are construed to be part of the broader goals of instruction or education. On this view, one of the significant features of development distinguishing it from research is that when an activity is begun, *the objective is known or established at the outset*. The objectives for a development project, ideally, are cast in the form of performance specifications (PS), and all activities are geared to producing the necessary products and processes which will meet those specifications. In Figure II, B indicates an initiative undertaken for development culminating in the creation of a process which meets performance specifications PS_b.

The top plane symbolizes the activities characteristic of school operations. The operating educational system can be said to be production oriented. Thus, the object of school operation is to act upon human beings in order to train and develop in them various skills, attitudes, beliefs, and knowledge calculated to serve both society and themselves. Certainly one of the significant features of initiatives in school operations is *the weight of the responsibility on the school administrator for choosing the right kinds of* processes to achieve the outputs that society and individuals specify. In Figure II, A represents an initiative to install a process leading to the production of education output EO_a.

A "Walk-Through" of the Model

To illustrate the relationships among the three types of activities, consider the following example. A responsible school official, faced with evidence that certain outputs desired by the society are not being achieved for a significant portion of the children in his charge, searches other school operations and ongoing or completed development projects for processes designed to meet his need. Should he find nothing to suit his particular problem (e.g., the low reading achievement of culturally disadvantaged children), he may then exercise his prerogative to call for the initiation of a project to design and develop a process

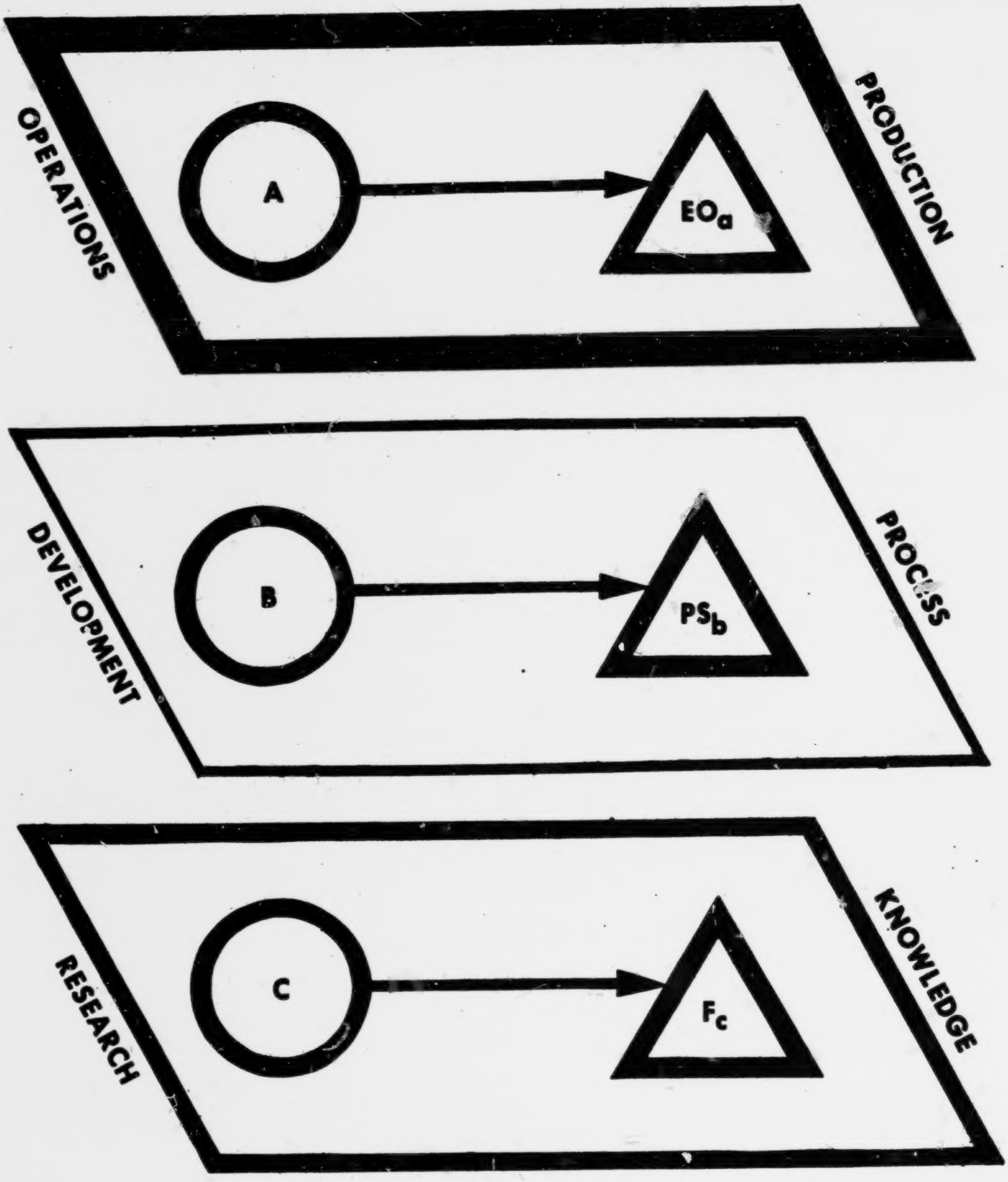

OPERATIONS
A
EO_a
PRODUCTION
DEVELOPMENT
B
PS_b
PROCESS
RESEARCH
C
F_c
KNOWLEDGE
AN INITIATIVE
AN OUTPUT

FIGURE II. AN OUTPUT MODEL OF EDUCATIONAL RESEARCH AND DEVELOPMENT

whose performance specifications are such that upon installation of the process in his school, it will yield the desired educational output (e.g., increased level of reading achievement in the target population).

Once the initiative for the development project has been undertaken and the performance specifications established, the development project then conducts a search for relevant research findings which may offer clues to guide the development project. (Whether or not this step is taken after the project is begun or immediately before is not really important. What is crucial is that at some point near the very beginning of the effort such a search is made). Impressed with a particular finding (perhaps, for example, the great impact of parental attitude on student achievement as revealed by the survey conducted as part of the Plowden study[8]), the project might decide to develop a process which deliberately tries to engender a large measure of parental involvement in home instructional experiences which, in turn, are carefully geared to complementary experiences in the school setting. Having made that decision, the developers might then discover that they require further information about the specific nature of optimum parent-child interactions to stimulate maximum learner achievement. They might therefore call for a specific initiative of a research activity to generate further data to guide the development of materials. When useful findings are identified, they can be incorporated in the development effort which then proceeds to a successful conclusion. When, using iterative techniques of design, development, trial, and redesign on the basis of feedback, materials encompassing both experiences and parent-child interactions in the home are successfully developed and validated, they may then be transferred to the operating setting where the administrator may install them as part of his instructional program.[9]

This example is illustrated in terms of the model by Figure III. EO_x at #1 symbolizes the social demand for a certain kind of educational output (in the example just given, higher reading achievement for culturally disadvantaged children). This demand creates pressure on the school administrator to respond with some sort of initiative. That initiative is represented by A at #2. It symbolizes his search for an effective process to install. Since he did not find it, his response was to call for a development initiative (B at #3). The next step was to develop the performance specifications (PS_x at #4) such that they correspond to the educational output desired by society. Once the specifications for the development project are established, the next step is to survey related research seeking guidance for the development effort. The search is conducted and the finding (F_{rx}) of relevance to the performance specifications and the desired educational output (e.g., the significance of parental attitude) is incorporated into the development project (#5). The call for additional research assistance is symbolized by D at #6. The incorporation of relevant findings (again Frx) from that initiative into the development effort is symbolized by the solid arrow to the development line at #7. Number 8 represents the completion of the development project, #9 the incorporation of the process into school operations, and #10 the production of the desired output, higher levels of reading achievement, as a consequence.

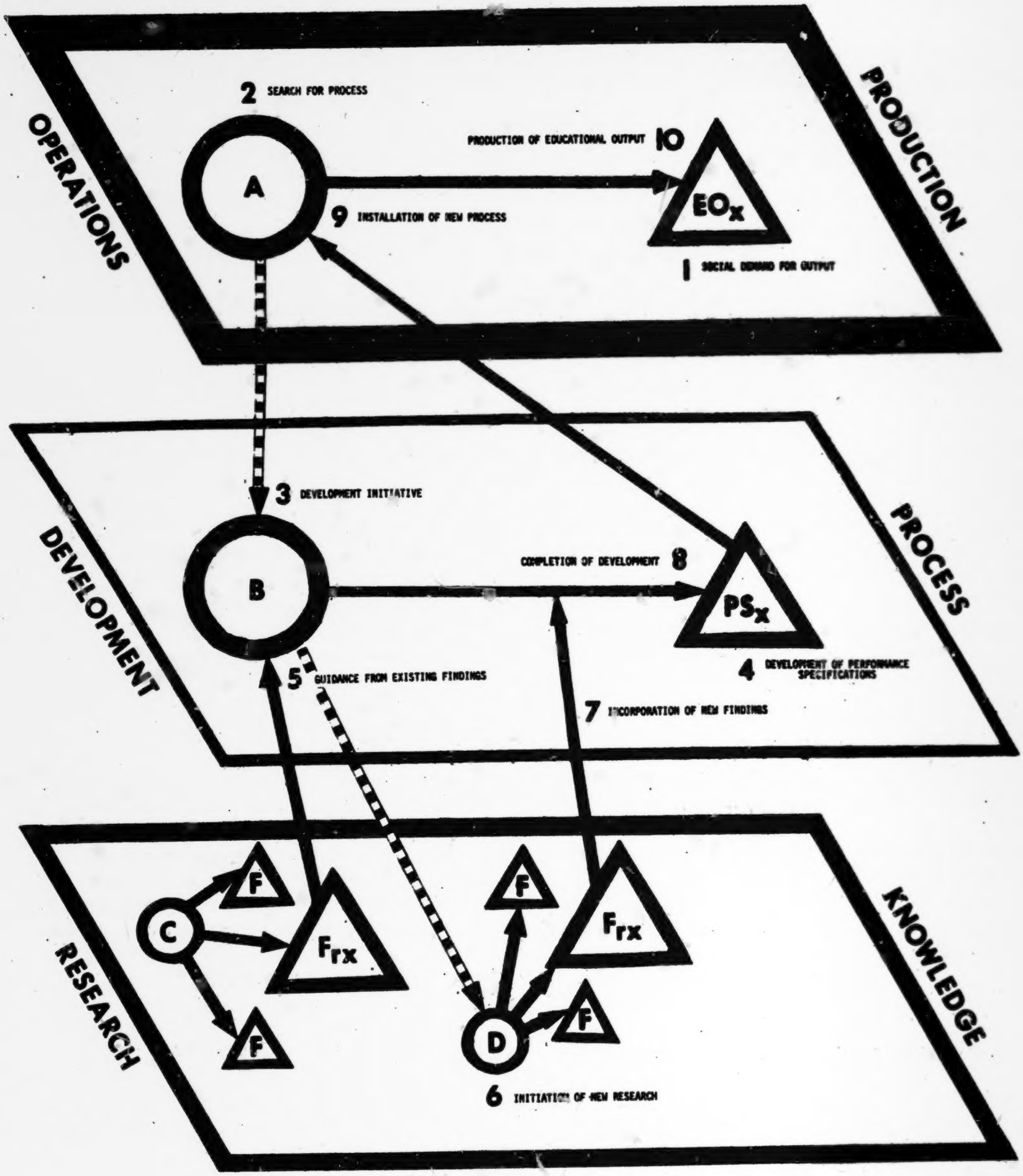

OPERATIONS
PRODUCTION
2 SEARCH FOR PROCESS
A
PRODUCTION OF EDUCATIONAL OUTPUT 10
EO$_x$
9 INSTALLATION OF NEW PROCESS
1 SOCIAL DEMAND FOR OUTPUT
DEVELOPMENT
PROCESS
3 DEVELOPMENT INITIATIVE
B
COMPLETION OF DEVELOPMENT 8
PS$_x$
4 DEVELOPMENT OF PERFORMANCE SPECIFICATIONS
5 GUIDANCE FROM EXISTING FINDINGS
7 INCORPORATION OF NEW FINDINGS
RESEARCH
KNOWLEDGE
C
F
F$_{rx}$
F
D
F
F$_{rx}$
F
6 INITIATION OF NEW RESEARCH
AN INITIATIVE
AN OUTPUT

FIGURE III. A "WALK-THROUGH" OF THE MODEL

A Sampling of Other Possible Interactions

The depiction of a sampling of other possible interactions among research, development, and operations can be found in Figure IV.

Example: A school official feels the need to assess the degree to which instructional programs are serving a particular target population. He calls, therefore, for an initiative in research. This is represented by the A/D/F/F interaction.

Example: An organization engaged in development independently concludes that it would be useful to develop a certain process or product for instruction. This is represented by the B/PS_b interaction.

Example: Research is initiated for its own sake and pursued solely for the knowledge which it produces. No findings have yet been incorporated either in development or operations. This is symbolized by the C/F, F, F relation in research.

Example: Research initiated for its own sake yields the findings that certain organizational structures for large city school systems are always problematical or that a certain vitamin supplement administered between the ages of five and seven can prevent a form of mental retardation whose appearance cannot be detected until somewhat later. Neither one of these findings needs to pass through development. Each can be implemented directly in school operations (if so desired). This kind of relationship of research to practice is illustrated by the G/F, $F/H/EO_g$ interaction.

Example: Finally, consider an instance in the form of the linear flow or Guba-Clark model from research to development to implementation. Research on early childhood and cognitive growth, for example, uncovers a number of findings, some of which may suggest the development of processes and environments which can actively enhance such growth. Development efforts are consequently supported and carried through to completion. The availability of the resulting products and processes is made known to educational administrators who are thereby persuaded to incorporate the newly developed early childhood instructional programs, at either private or public expense, into the Nation's educational system. This kind of sequence is represented by the J/F, F, F, $F/K/PS_j/L/EO_j$ interaction[10].

The Model as an Heuristic

All of these representations in Figures II, III, and IV are fairly obvious and straightforward. The use of the model as an heuristic, however, profits from further explanation. One of these uses pertains directly to the problem of "change process" as applied to education. I have tried to structure the model (1) to illustrate that the incorporation of research findings into development is just as important as incorporating newly developed processes into operational settings (2) and also to imply that it oftentimes may be just as difficult a proposition. The notion that there are obligations on both research and development to transfer their "products" to other activities means that each must pay careful attention to the way in which its outputs are presented and, perhaps the very way in which the outputs are produced. In other words, the requirement that eventually there

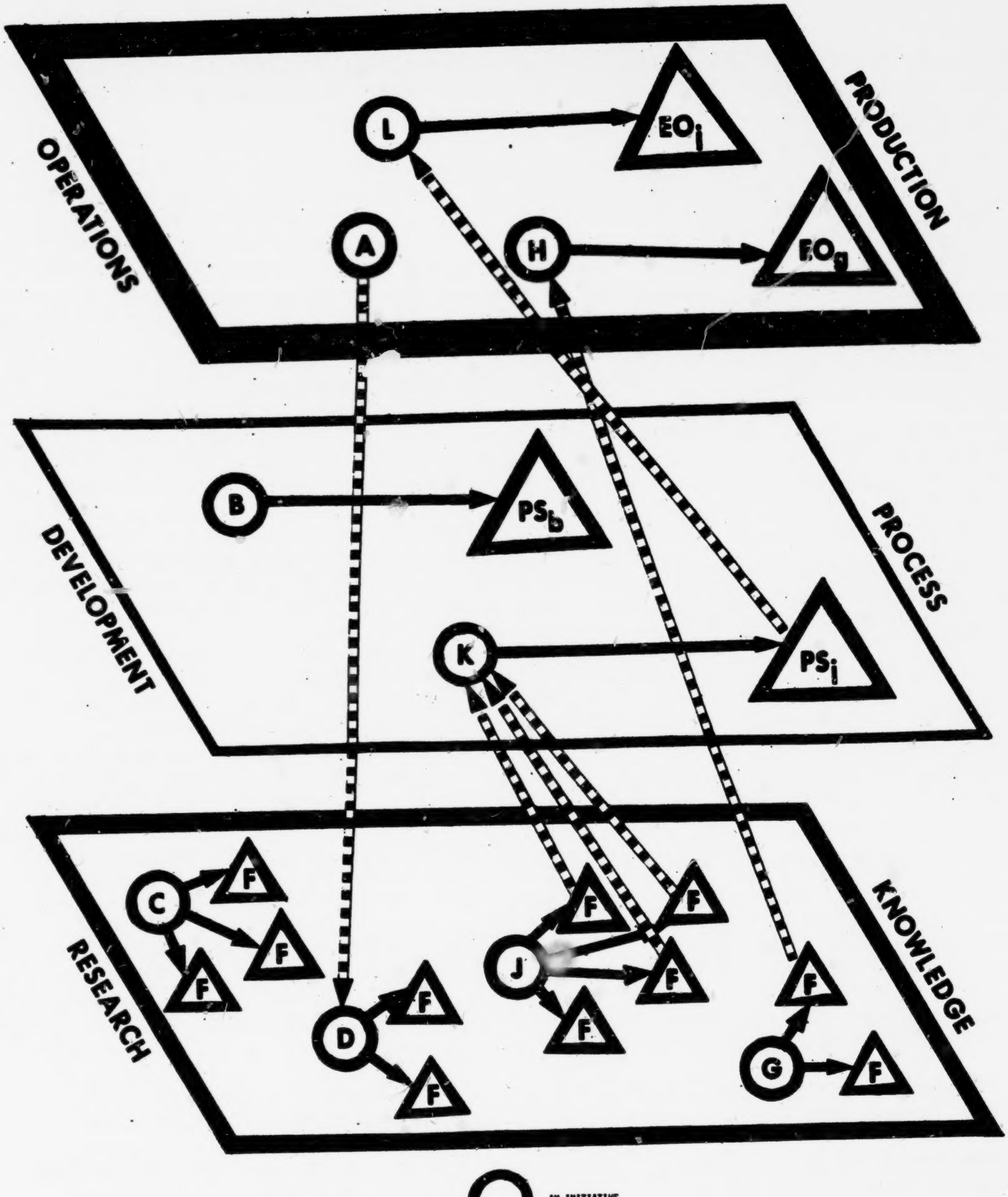

OPERATIONS
PRODUCTION
L
EO$_i$
A
H
EO$_g$
DEVELOPMENT
PROCESS
B
PS$_b$
K
PS$_i$
RESEARCH
KNOWLEDGE
C
F
F
F
D
F
F
J
F
F
F
F
F
G
F
F
AN INITIATIVE
AN OUTPUT

FIGURE IV. A SAMPLING OF OTHER POSSIBLE INTERACTIONS

be transfer or incorporation into another type of activity places constraints upon the professional behavior in each activity which cannot be ignored without compromising later impact.

This requirement is particularly true for development projects, but I think it is as true for research activities. A few concrete examples illustrate the point. A most simple one is the researcher who publishes perfectly valid findings in a sloppy or difficult format and thereby hinders the likelihood of their being incorporated ultimately into practice. The researcher who inadvertently conceals or compromises his methodology or design encounters similar problems.

Similarly, the final requirement for a development project is that it be usable in operational settings. The ultimate desire to incorporate the developed process in school operations means that one of the performance specifications for development must always be the provision of procedures (teachers' manuals, training procedures, etc.) for accomplishing the installation of the innovations. If the development is undertaken without reference to that fact (if, in short, the requirement for transfer is not built into the performance specifications), the developer may well have rendered his product unusable. Hence, for example, the desire to involve teachers and other practitioners in the development process stems from the need to have their expertise and experience continually represented. They carry embodied within them, in effect, the knowledge of many of the operational possibilities and constraints within which the finished process will operate There are other good reasons for involving teachers as well, not the least of them being the respectability lent to the project in the eyes of the practitioners at large by virtue of the meaningful presence of teachers in the effort. This last consideration is of no small importance in securing acceptance of the innovation in the profession at large. The nature of its importance, however, should not be mistaken; the involvement must be meaningful and not merely window-dressing, for the respectability is lent by their presence only if their contributions are fully utilized and their real knowledge of what is or may be possible is thoroughly weighed in the development effort.

One final point should be made about the model's portrayal of the possibility for transfers back and forth among research, development, and operations. Emphasis clearly needs to be given to the problem of information flow and the need for carefully considering techniques for installation of better knowledge and better processes into their intended settings. Only part of this is the direct responsibility of the researchers and the developers. Those with obligations for considering the entire R&D system for improvement need also to direct their attention to these diffusion processes.

A second feature of the model as an heuristic is the way it helps to clear up part of the problem of distinguishing between basic and applied research in education[11]. The model clearly implies that basic research (studies generated independently in research for the sake of the findings alone) and applied research (research conducted to serve a particular need identified by people engaged in development of operations) differ from one another primarily in terms of the intent of the initiator[12]. Thus the knowledge-orientation of the basic researcher is central to his activity. Applied research is also supported for the knowledge which results from it, but the initiator of the research knows to what instrumental use he is going to put the findings. By depicting both applied and basic research as similar kinds of activities, the model implies that in and of themselves they look very much alike. The procedures, the design, the sophistication must all be on par if either is to be valuable. What distinguishes the two from one another, if anything does, are the purposes for which they are initiated[13].

A third feature of the model as a heuristic is its suggestion that decisions to initiate activities of each of the three types are made according to quite different criteria and perhaps by quite different people. The fundamental scientific character of research suggests that independent initiatives exercised there depend heavily on advice from the science community. Development projects, however, can also be independently initiated, but decisions to begin these kinds of activities are subject to advice from both research and operations. With limited resources, deciding which needs to satisfy through development (for example, those independently generated by developers, compared to those stemming directly from school operations, compared to those growing out of research activities) becomes a particularly difficult problem. Finally, the kinds of lonely decisions required of school administrators at the operational level are made by people in the context of still different circumstances and institutions. By emphasizing the essentially different nature of the activities being undertaken, the model reminds the policy maker of the need to collect different kinds of data and statements of need when planning future activities.

Finally, the frank attempt to represent each of the activities in terms of particular kinds of outputs may well turn out to be the most significant aspect of the model. It forces the viewer of the model to consider what the outputs of each activity are and to think about how the outputs of each activity are of use to one another. The outputs of research, for example, are knowledge. Some of the knowledge produced through research will find its way into development and into school operation. Are there ways of improving the output of research, making it more powerful, increase the likelihood of its being of use to instruction and education?

What about the outputs of development? They constitute, on the one hand, the validation of research and, on the other, the means by which the educational system can improve the manner in which it carries out its functions. How can development be improved, how can research be organized to be of greater use to development, and how can the educational system itself orient its organization to the recurring need for the installation of more powerful validated techniques?

Finally, what happens to educational operations when they begin to view their responsibilities in terms of output? The contrast can perhaps be most sharply drawn by considering the implications of the notion of grading schools on the basis of their outputs rather than students on the basis of their performance. The existing practice of grading students assumes at bottom that the student is responsible for his learning and that his failure or success is a tribute to or a consequence of factors intrinsic to him. The idea of grading a school on the basis of its outputs assumes quite to the contrary that all students can learn and that the responsibility of the schools is to make that happen. (In medicine and law, for example, we judge success or failure of the system not so much by the patient's or client's end state as by the degree to which the doctors or lawyers skillfully utilized the most sophisticated practices in attempting to serve the client. We certainly do not "grade" the patient or client; quite to the contrary, it is the professional services themselves which are assessed. An output orientation for school operations would cause the same reorientation of the direction of assessment in education.) If the schools themselves are judged in terms of the degree to which they are accomplishing their "production goals", increasingly they may come to orient their activities to assessing their own effectiveness, identifying the techniques and processes which need improvement and, as a consequence, calling with increasing sophistication for the kind of development activity and research support which will provide the basis for continuing improvement.

Summary

I have, in this paper, presented an output-oriented model of educational research and development. I have tried to show that the outputs of research, development, and operating educational institutions are quite different, that performers of each of the three types of functions have important contributions to make in identifying proposed initiatives in their own sphere as well as all the others, and that these conditions create special demands upon the administrator of research. He must listen not only to science, but also to the behavioral technologist and the professionals administering educational programs of all kinds. The model suggests the importance of adequate dissemination and diffusion mechanisms among the different functions, the importance of the manner of performing the activities in each function in making transfer and feedback from one function to another possible, and the importance of collecting information from a broad range of input sources before making priority judgments. Finally, the discussion suggests that the notion of an output orientation in the educational system itself may well be the most significant procedural and managerial innovation we can think of because of the ways in which it may cause education professionals to identify deficiencies in service and seek out research and development which will continually contribute to their efforts to serve society well.

Footnotes

1. P. Handler, "Academic Science and the Federal Government", *Science*, Vol. 157, September 8, 1967, pp. 1140-1146.

2. G.H. Daniels, "The Pure-Science Ideal and Democratic Culture", *Science*,Vol. 156, June 30, 1967, pp. 1699-1705.

3. H. Brooks, "Applied Science and Technological Progress", *Science*, Vol. 156, June 30, 1967, pp. 1706-1712.

4. L.A. Dubridge, "University Basic Research", *Science*, Vol. 157, August 11, 1967, pp. 648-650.

5. M.D. Reagan, "Basic and Applied Research: A Meaningful Distinction?", *Science*, Vol. 155, March 17, 1967, pp. 1383-1386.

6. *Ibid*., 1386.

7. E.G. Guba and D.L. Clark, *An Examination of Potential Change Roles in Education* (mimeographed, Airlie House, Virginia, p. 8).

8. *Children and Their Primary Schools: A Report of the Central Advisory Council for Education*, Her Majesty's Stationery Office, 1967, Vol. II, pp. 180 and 188.

9. I am indebted to Robert Glazer for his suggestion that somewhere (and here is as good a place as any) I make explicit the assumption that in education a breed of developers and technicians exists, and that researchers, developers, and school administrators are presently skilled and courageous enough to identify and fulfill research and developments requirements (as Glazer put it to me, superhuman enough to know when and how to initiate development, how to set up performance specifications, and possessing both the courage and political climate which will permit iterative experimentation and not just a "safe improvement"). Those assumptions are present not because I think conditions in the field fully warrant them, but because assuming that such conditions should be present seems to me to be useful.

10. This example is, of course, clearly an ideal conceptualization. It is instructive to keep the model in mind as one looks back over the past four years at the tremendous developing interest in the establishment of early childhood educational programs. While it is certainly difficult if not impossible to establish an individual cause for such a complex phenomenon, it is nonetheless significant, I think, that Benjamin Bloom published his volume, *Stability and Change in Human Characteristics* (John Wiley and Sons, Inc., New York, 1964) just at the time the Office of Economic Opportunity was beginning its planning

toward the development of programs to fight the war against poverty. The significant thing about Professor Bloom's volume, however, was that while his conclusions firmly underscored the importance of the early years in the development of cognitive skills, he also pointedly observed that there had been little actual experimentation designed to create environments to enhance such skill development. I do not think that it does violence to Dr. Bloom's argument to interpret it as a call for rigorous development efforts designed to produce environments and instructional programs which have the effect of enhancing human capabilities. The problem, however, is that which exists in all social domains. There are large numbers of children now whom we cannot afford to ignore, and the consequence has been the attempt to create operating early childhood programs based on those convincing research findings without first having gone through a developmental stage. The result has been a somewhat marginal impact on the target population despite the clear implications of the research summarized by Prof. Bloom.

11. I think it is also useful at this point to recall Professor Reagan's view that the social sciences present something of a different picture in regard to the distinction between basic and applied research. As he points out (Reagan, op. cit., p. 1385), no matter how abstruse and abstract its practitioners attempt to become, social science research is inherently related to potential applications.

12. The initiator and performer are, or course, not necessarily one and the same person or institution. The actual initiator of the research project might be a school man, a developer, a researcher, or a research administrator. The performer of that research effort may or may not have the same ultimate purpose as the initiator in mind as he undertakes the activity. Thus, for example, it would be perfectly possible for a research administrator to stimulate a series of research activities relating to reading which he views as applied research necessary for a development effort to build improved reading curricula, while the performer of that research sees it as a basic research effort in perception or the psychomotor skills associated with reading.

13. This view, I believe, fits fairly well with one part of Harvey Brooks' analysis of the distinctions between basic and applied research (Brooks, op. cit., p. 1706) when he noted that "as definite categories, (the terms) basic and applied tend to be meaningless, but as positions on a scale within a given environment they probably do have some significance." The principal shortcoming with Brooks' analysis in my view is that it proceeds almost entirely on the presumption that the distinction can be resolved by approaching it in some way from the researcher's point of view. My experience in the administration of research, as the model presented in the paper clearly indicated, leads me to believe that the researcher's view is only one of several which must be taken into account in attempting any analysis of the distinction criteria and alternative vantage points convinces me that Reagan's argument for abandoning the distinction within research is much more persuasive as is the suggestion that the critical categorization is that between research and development.

14. I thank Elvin Svenson who some months ago, in classic Socratic fashion during an extended interchange, provoked me to clarify many of the ideas presented in this paper.

Discussion

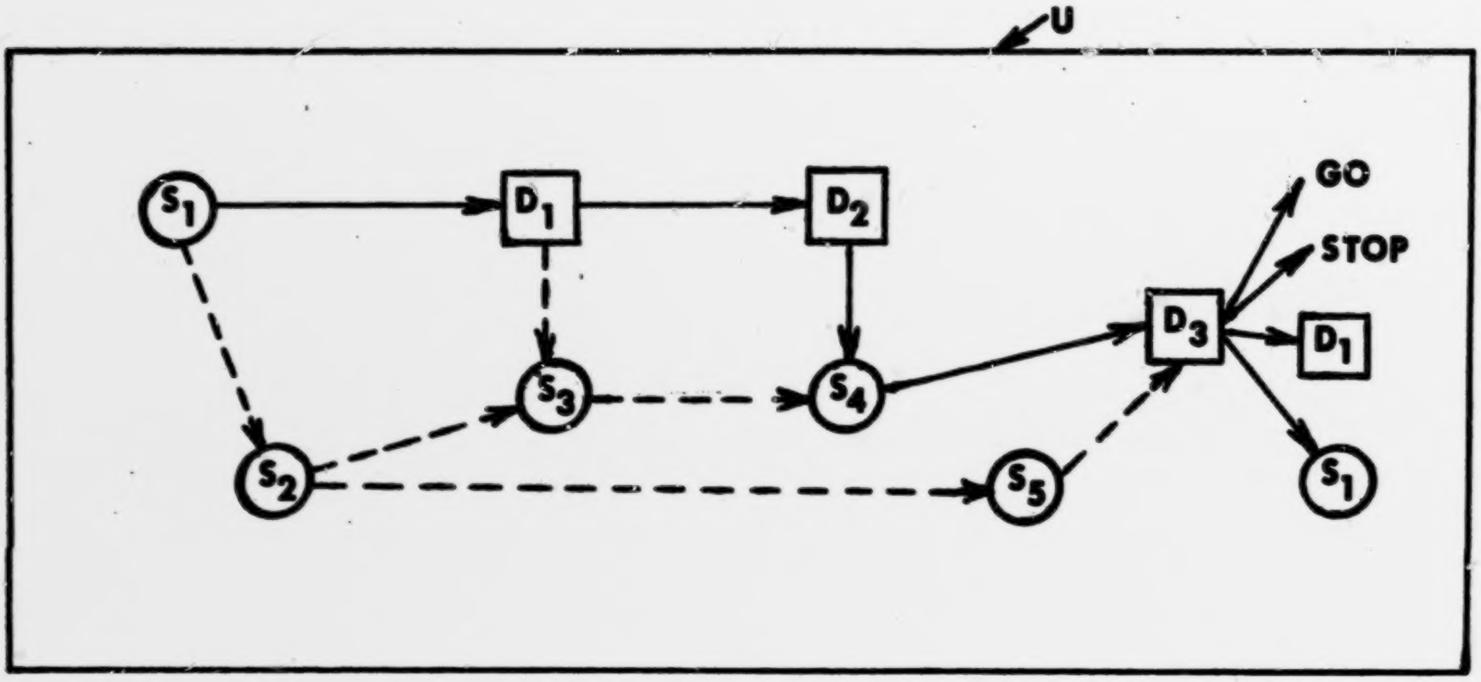
The June 14th meeting opened with a summary of the previous day's discussion by Dr. Moss, Conference Co-director. The summary was discussed and approved after some additions and revisions.

The paper by Dr. Gideonse was discussed and the following points and questions were noted.

1. A broadly representative group, including scientists, program operators, and others, should make the decisions concerning the allocation of educational research and development funds to various functions. These decisions have great influence upon the direction of change in education; they act to mold the future.
2. Developmental projects may be initiated from any source. After initiation, representatives from development, research, and operation activities are inevitably involved in the process.
3. There is a professional responsibility to disseminate accurately the results of research, development and operation within the profession and to the public. The form taken for dissemination, however, probably needs to be tailored to specific audiences if it is to be meaningful and relevant. The development process includes some dissemination and diffusion activities. Communication with other developers and researchers may be the responsibility of a special group of translators or the developers themselves.
4. The large majority of conferees favored treating diffusion of the product of the developmental process to operators as an activity separate from the developmental process because of its magnitude and importance, and because of the kinds of complex problems and considerations it entails. Communication with operators should usually be accomplished by a special group of translators/marketers who interpret relevant outcomes of research and development in accurate, understandable terms to special publics of operators, and who have the responsibility of helping operators make more rational decisions about the adoption of potential educational changes.
5. One of the problems of marketing the developed products is that many schools are not now aware of the outcomes and costs of their present programs. This information could provide the rational base for comparing the feasibility of potential changes. The developer, through the diffuser/marketer, has the professional responsibility of providing truthful data about his own innovative program outcomes (including costs) based upon formative and summative evaluations, as a necessary part of the developmental process.
6. It is evident that the usefulness of the developmental process rests on the validity and reliability of the criteria used to evaluate the product of the process. The profession has given insufficient attention to the derivation of evaluative criteria and their measurement.

A portion of the afternoon's discussion concerned question 2 of the conference guidelines (How should one go about planning or conducting educational development projects?).

1. A "theory model", described in detail in a project report by Drs. Maccia*, was proposed as useful in the developmental process. A decision procedure derived in part from their theory model was offered as a strategy for planning educational development projects.



○ stands for a SPECIFICATION □ stands for a DECISION

(a) U - A prerequisite to the application of the strategy is a problem, which seems to tentatively determine the universe of concern (e.g., goals, target group, program characteristics, interacting variables).

(b) S_1 is the specification of all the critical elements (variables), or clusters of critical elements if necessary, in the universe. The critical elements are those with which developers should be concerned in considering the problem. There are also non-critical elements in the universe which the developer will deliberately ignore because they are not germane to the problem. Reviews of research, practice, theory, and the use of consultants are techniques helpful in identifying the critical elements.

(c) S_2 is the specification of all the relationships among critical elements, as these are determined by prior research, theory, practice, expertise, etc. Relationships among critical elements which are not known (cannot be specified) indicate needed research. In the event that one or more relationships are not known, several alternatives are available: Stop the process and redefine the

the problem and universe; Consider alternative relationships and carry forward in subsequent steps the consequences of all alternatives; Assume relationships and thus make these assumptions explicit for later diagnosis.

(d) $\boxed{D_1}$ represents the decision to select one or more critical elements as the dependent variables (goals) of the instructional process to be developed.

(e) $\textcircled{S_3}$ is the specification of all of the relationships among critical elements which are related to the selected dependent (outcome) elements decided upon at $\boxed{D_1}$. $\textcircled{S_3}$ is thus a subset of $\textcircled{S_2}$ and these relationships are constraints upon the dependent outcome elements.

(f) $\boxed{D_2}$ is the decision as to the desired condition of the product of the developmental process. The critical elements of the developmental process will be manipulated (increased, decreased or changed in some other ways) to attain a desired condition.

(g) $\textcircled{S_4}$ is the specification of all of the relationships among the critical elements (from $\textcircled{S_3}$) to optimize. Manipulation of these relationships (ie. independent variables) will bring about the desired change (from $\boxed{D_2}$) in the value of the selected outcome elements (from $\boxed{D_1}$). They are the critical elements which the developmental product will seek to optimize.

(h) $\textcircled{S_5}$ is the specification of all of the other reactions (outcomes or concomitant effects) which will occur when the $\textcircled{S_4}$ relationships are optimized. $\textcircled{S_5}$ relationships are subsets from those specified at $\textcircled{S_2}$.

(i) $\boxed{D_3}$ is the go, no-go decision; whether or not to proceed with the development process. If too many undesirable effects of optimizing $\textcircled{S_4}$ variables are anticipated by the $\textcircled{S_5}$ specifications, then the decision may be to change the $\boxed{D_1}$ decision, to re-examine the $\textcircled{S_1}$ specifications, or even to alter the universe of concern.

2. A favorable outcome of the use of the strategy results in a decision concerning project goals (expected outcomes), the critical elements to be manipulated by the developmental product, the variables (critical elements) to control, and the anticipated side effects.

3. The strategy model helps to specify the assumptions made (relationship among critical elements), the limitations on a project (as defined by the universe), and the selection of variables to be controlled. If the product of the developmental process doesn't work, reference can be made to particular sequences in the strategy model (e.g assumptions) to detect the basis for failure. The strategy can also be useful in generating alternative procedures for conducting developmental projects by (a) the specification of alternate relationships among critical elements, and (b) the specification of different sets of elements to be optimized.

4. Discussion began to focus upon the developmental steps which would follow the application of the above strategy. A useful distinction was recognized between the substantive development questions to be answered and the organizational-sociological decisions to be made.

5. The former might include the need to answer questions like: How specifically should one's objectives be stated at the beginning of the project? Is this a possible function of project complexity? Can objectives be made content-free? How can the variables to be optimized be operationalized? In what form(s) should the product(s) be finalized? How instantaneously should feedback be secured during the development, and from whom should it be secured?

6. The organizational-sociological questions involve how and by whom these questions should be answered, and the work of the project carried out. For example, what should be the relationship between formative evaluators and writers in the development process? How and when should consultants be employed?

7. The major substantive steps following the design stage were felt to be: (a) develop, (b) test (formative) diagnostically, (c) re-design and redevelop, (d) retest (formatively), (e) repeat as needed, and (f) summative evaluation

Conferees' Conclusions

The conferees as a group agreed that no one model of the developmental process would be equally representative of all developmental projects. The complexity of the problem and its aims, and the uniqueness of those aims, are two variables which might influence the choice of the most efficient process. But it is possible and desirable to develop a model of the developmental process at whatever the level of generality required.

Individual conferees made the following concluding remarks:

1. Every development project must include a summative evaluation (an estimate of an operational program's overall effectiveness) which compares the development product with the standard product. Schools need information on their own program's output and costs at the same level of precision as the developer's data so that they can make rational decisions concerning adoption; such data will tend to reduce uncertainty with respect to the dimension of the decision making process which is affected, whether this dimension is economic, political, or otherwise.
2. Developers must clearly define their universe of concern, distinct from axiological considerations, but including a utility base. They must provide for the disclosure of "side effects" of their products. An agency independent of the development responsibility is needed to show the rationality of using the new versus the old practice.
3. Sociological considerations (the personalities and organizational arrangements involved) are a critical factor in determining the nature of the project goals, the actual outcomes, and the acceptability of those outcomes.
4. There are two kinds of expected outcomes from developmental projects. The first are commonly accepted, standard goals which the project wishes to attain with maximum efficiency. The second kind of outcomes are new, unique educational ends. The latter introduce a great many value considerations into the developmental process, and make comparative (with existing programs) evaluation difficult.
5. The complexity of the problem selected for the developmental project influences the procedures used in the developmental process. It can, for instance, affect the decision concerning specificity of objectives which can or should be stated at the outset of the project. Note also, that we can have small development projects within larger developmental projects.

Conference Co-Directors' Summary

The three co-directors have reached the following tentative conclusions concerning (a) the substantive questions dealt with by the conferees, and (b) the conference procedures employed.

1. Conferees were able to reach substantial agreement upon the definition of developmental activities, and their relationship to research and to diffusion activities.

2. There are essential similarities in the basic procedures and types of decisions required by research and by development activities. Both are, after all, problem-solving activities and general problem-solving models, like Dewey's, can be applied with equal ease to both.

3. On the other hand, when more specific procedures and decisions are considered, research and development become quite distinguishable as the result of at least three differences in their respective products: (a) Development is committed to fabricating an instructional product to meet certain specifications, which implies reiteration of the design-development-test sequence; (b) development places its emphasis upon the fabrication of a product (treatment); (c) development requires that its product be operational; (d) development deals with educational systems, therefore it is necessary to consider both positive and negative outcomes of any changes made within the system; too often potential negative outcomes are completely ignored.

4. It appears evident that useful models can (and should) be specified for planning developmental projects. Differences in the size and complexity, and nature of the outcomes (common, or unusual outcomes) of developmental projects, however, might dictate the need for adaptation in any one model that might be formulated.

5. Models for planning developmental projects should probably incorporate provisions for considering two kinds of decisions: (a) Substantive, dealing with stages in the creation of the product, and (b) process, dealing with the utilization of human resources.

6. Participants in the conference were not expected to evaluate preconceived ideas of the conference co-directors. Rather, the intent of the conference was to optimize creative inputs from the participants. In order to facilitate this objective (a) a relatively unstructured format was adopted, (b) the total number of participants was severely limited, and (c) neither the conference leader nor the co-directors felt compelled to direct the discussions or to censor points of view which were expressed. While the relatively unstructured nature of the conference may have been a little unsettling for some participants, it is the opinion of the co-directors that the procedures employed did serve the intended purposes reasonably well.

7. Publication and dissemination of this report by the Minnesota Research Coordination Unit in Occupational Education represents the first step in a series of subsequent activities which might be taken as a result of the conference.

Since many of the salient points presented in the papers and discussions are controversial, they are expected to provoke additional discussion among educators, researchers, and funders of educational development projects. Accordingly, the Coordination Unit's next steps will be to explore, in more detail, the adaptation and application of potential decision-making models to developmental projects which differ in terms of size, complexity, and outcomes.